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COMPLIANCE OF SELECTED WATER QUALITY PARAMETERS TO THE OBJECTIVES OF THE INTERNATIONAL WATERS OF THE SAINT JOHN RIVER BASIN DURING THE YEARS 1984 AND 1985

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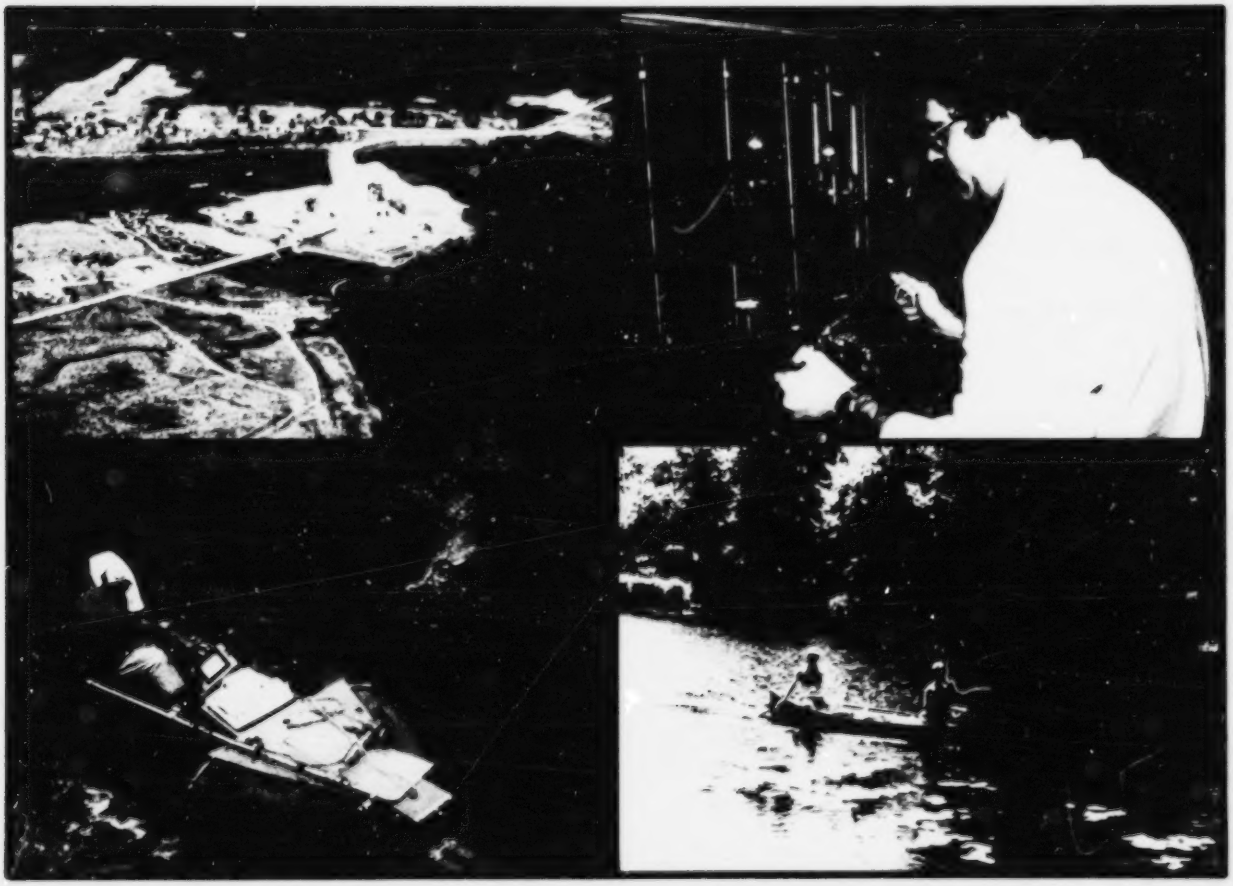

INLAND WATERS DIRECTORATE
ATLANTIC REGION
WATER QUALITY BRANCH
MONCTON, NEW BRUNSWICK

Canada

COMPLIANCE OF SELECTED WATER QUALITY PARAMETERS TO THE OBJECTIVES OF THE INTERNATIONAL WATERS OF THE SAINT JOHN RIVER BASIN

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A copy will be made available in French upon request

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ABSTRACT

This report compares the 1984/1985 water quality data for the Saint John River with the Water Quality Objectives for selected parameters. Values of grab sample measurements for dissolved oxygen, pH, extractable and dissolved aluminum, total and dissolved phosphorus, suspended solids, and extractable copper, lead, zinc and mercury are compared to the "safe" and "acute" objectives. Median concentrations of extractable aluminum were below the "safe" objective at all sampling sites, although the mean concentration in the Saint John River at St. Basile was slightly above the "safe" objective, probably the result of waste water discharge from the Madawaska, Me. paper mill where alum is used in the paper making process.

Based upon experience in the State of Maine, where it has been found that levels of phosphorus (dissolved) higher than 0.015 mg/L on a seasonal basis is indicative of a potential eutrophication problem, the median level of 0.022 mg/L found in the Aroostook River at Tinker Dam over the two year sampling period suggests that eutrophication should be of concern in this sub-basin.

Suspended solids concentrations at all of the sites sampled were generally less than 10.0 mg/L, although samples collected after an intense summer rainfall event were found to have higher levels, indicating the possibility of poor land use practices in parts of the basin.

Heavy metal concentrations at all of the sites sampled were well below the water quality objectives established for the basin, and were generally below the detection limit of the analytical method used.

INTRODUCTION

The 120 km reach of the Saint John River from the St. Francis River to Grand Falls forms the international boundary between Canada and the United States. In February 1975, use specific Water Quality Objectives for the international waters of the Saint John River were recommended for 61 parameters and a number of pesticides. Since then, these objectives have been revised and the recommended changes have been presented in the report of the International Technical Advisory Subcommittee on Water Quality in the Saint John River (ITAS, 1980). They have now been accepted by both governments as water quality goals to reach for in the management of water quality in the international Saint John River basin.

The objectives are based on the fishable-swimmable criteria, incorporated into United States legislation and agreed to by the Canada-US Committee in 1975. They are a combination of Water Quality Objectives developed separately for fisheries and contact recreation uses. Generally, if the water quality is degraded to a level slightly worse than the recommended objective, a threat to one or more of the intended uses could be expected.

With each objective, two separate levels of quality were developed to support the fisheries or aquatic biota aspect. A single Objective for the "safe level" represents the long-term management goal and should be compared to annual or seasonal

averages of monitoring data, and an alert or "acute" level identifies immediate problems within single grab samples.

The Water Quality Branch presently monitors the international portion of the Saint John River and its tributaries on a regular basis to provide data for comparison with the established Water Quality Objectives. Samples were collected from twenty water quality stations in 1984 and from eleven stations in 1985. Table 1 lists the locations of the sampling stations and the corresponding NAQUADAT station numbers.

Because this sampling program has been designed for comparison of annual mean and grab sample values with the established objectives, no rigorous interpretation of the data will be attempted. However, some operational difficulties will be discussed regarding the application of data collected during routine grab sample monitoring in determining compliance with the water quality objectives.

This report presents the results of the 1984/85 sampling program and compares the data with objectives for selected parameters. These parameters and the NAQUADAT codes referring to the analytical methods used are presented in Table 2.

Table 1

International Saint John River
Sampling Stations 1984-1985

1.	00NB01AD0001	Saint John River at Clair
2.	00NB01AD0008	Saint John River at Edmundston - Madawaska Bridge
3.	00NB01AD0009	Little River at Hwy 205 near Pelletier Mills
4.	00NB01AD0013	St. Francis River at Picnic Site
5.	00NB01AD0016	Madawaska River at Power Plant Tailrace
6.	00NB01AD0017	Saint John River at Caron Brook
7.	00NB01AD0019	Baker Brook at Hwy 120 in Baker Brook
8.	00NB01AD0031	Saint John River upstream of confluence with St. Francis River
9.	00NB01AF0002	Saint John River at St. Leonard
10.	00NB01AF0014	Seigas River at Seigas
11.	00NB01AF0015	Quisbis River at Seigas
12.	00NB01AF0019	Iroquois River in Iroquois
13.	00NB01AF0021	Green River at W.S.C. Gauge
14.	00NB01AF0023	Grand River at Hwy 2 bridge
15.	00NB01AF0038	Saint John River at St. Basile
16.	00NB01AG0003	Limestone River at Four Falls at W.S.C. Gauge
17.	00NB01AJ0012	Big Presque Isle Stream at Canada-U.S. border
18.	00NB01AJ0029	Meduxnekeag River at Belleville
19.	01NB01AF0005	Saint John River above Grand Falls Dam
20.	01NB01AG0001	Aroostook River at Tinker Dam

TABLE 2

Selected Water Quality Parameters Analyzed In
Water Samples Collected from International Saint John River Basin
During 1984-1985

AQUADAT Code	Parameter Analyzed
8102F&S	Dissolved Oxygen
0301F	pH (field measured)
0301L	pH (lab measured)
2065S	Water Temperature
3305P	Extractable Aluminum
3102L	Dissolved Aluminum
3106L	Dissolved Aluminum
5413P	Total Phosphorus
5104L	Total Dissolved Phosphorus
0401L	Non-filterable Residue
9305P	Extractable Copper
0304P	Extractable Zinc
2302P	Extractable Lead
0315P	Extractable Mercury

RESULTS AND DISCUSSION

A previous report (IWD-AR-WQB-84-56) discussed some of the difficulties in comparing grab sampling data to the water quality objectives. Water quality conditions are the function of complex natural and man-made causes and often vary widely in both space and time. For this reason, it is not easy to design a program to provide water quality data which will ensure that objectives are being met or not met on a statistically sound basis and stay within the constraints imposed on manpower and economics.

Because many of the parameters can only be measured in the laboratory, small sample size is a problem common to many routine monitoring programs, and the resulting data is usually not normally distributed. Because of this non-normality of distribution, the use of parametric statistics to analyze the data is generally statistically unsound. For this reason, the use of yearly or two yearly arithmetic means of the parameter levels to compare with water quality Objectives is not appropriate, and it is felt that the non-parametric median value is the more appropriate statistic to use in comparing the grab sampling data to the water quality objectives.

Many water quality parameters undergo wide seasonal fluctions, being dependent on variations in the hydrological cycle. Logistically, it is very difficult to design a grab sampling program which will cover the full range of hydrological and

seasonal conditions in a stream, and it is quite likely that mean or even median values calculated from a small number of observations may be biased either high or low depending upon river discharge and antecedent conditions at the time of sampling. Hence, even though the median value is preferred over the mean, it also must be used with caution when calculated from a small number of observations.

There are several problems with the use of "acute" objectives and individual observations. In addition to the importance of river discharge, and the inability of the relatively infrequent grab sampling program to cover the full range of hydrologic conditions in a river, there is a problem with inprecision of measurement which sometimes occurs during routine grab sampling programs. For this reason, although individual observations may be compared to the "acute" objectives, they should not be used to estimate the overall percentage of compliance or non-compliance.

Methods

All samples were collected in the field using the procedures outlined in Anonymous, 1983. Samples for dissolved aluminum and dissolved phosphorus were filtered in the field within 6 hours of collection. Samples for dissolved aluminum were filtered through Millipore 0.45 um membrane filters (HAWP 047 00) and those for dissolved phosphorus were filtered through Gelman glass fiber filters (Spectro Grade). All samples requiring preservation were

preserved in the field within 6 hours of sample collection.

Data analysis and graphing were performed on a VAX 11/750 mini-computer using the RS/1 software package. Figures 3 to 15 are box and whisker plots of the water quality data, a means of graphically protraying the minimum, 25th percentile, median, 75th percentile and maximum values. Figure 1 explains the significance of the various parts of the box and whisker plots.

For purposes of calculating measures of central tendency and graphing of the water quality data, parameter values below the limits of detection were arbitrarily set to 90% of the detection limit.

Quality Control/Assurance

Field quality control/assurance techniques employed on a routine basis during the collection of water samples for comparison with water quality objectives in the International Saint John River basin are outlined in detail in the draft report "Water Quality Branch, Atlantic Region, Field Quality Control/Quality Assurance Program".

In general, the more significant components of this aspect of the field sampling portion of this project were as follows:

1. Field blanks were prepared in the field at the end of each

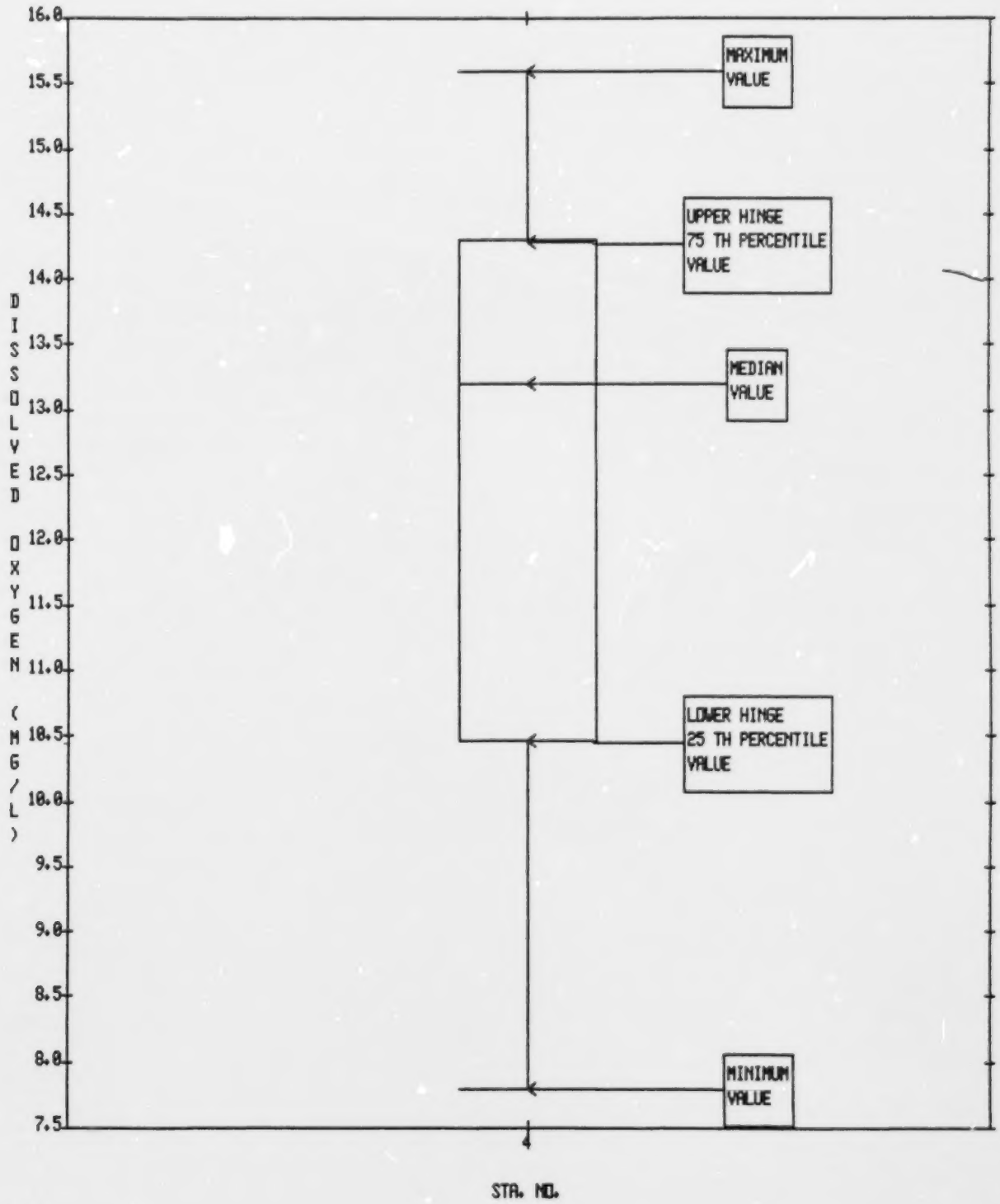
sampling day for parameters requiring the addition of a preservative reagent by transporting ultrapure distilled water from the laboratory to the field in regular sample bottles and adding the preservative reagent to the distilled water in the bottle in the same fashion as the collected water samples. The analytical results of these "field blanks" are shown in table 3, and are discussed below.

2. Field filter blanks were prepared at the end of each sampling day (when samples requiring filtration were filtered). This consisted of filtering ultrapure distilled water through the type of filter used for determining the dissolved portion of the parameter of interest, and preserving the "filter blank" in the same manner as collected samples were preserved. This was done for the Millipore Membrane filters used to filter samples for dissolved aluminum and for the Gelman glass fiber filters used to filter samples for dissolved total phosphorus.

   The analytical results of these "filter blanks" are shown in Table 4, and are discussed below.

3. Sequential triplicate sampling was employed for approximately 15% of all samples collected during the 1984-1985 sampling period. Sequential triplicate sampling means the collection of three separate grab samples at a particular water quality sampling station for laboratory analysis for all parameters of interest. The term sequential is used, because strictly

FIG. 1
BOX AND WHISKER PLOT



speaking, the samples are not taken simultaneously, but are taken one after the other in a time span of roughly ten minutes. Triplicate sampling is employed to measure the degree of repeatability of the entire data gathering process, including sample collection, laboratory analysis and data processing. The triplicate samples are treated throughout the data gathering process as regular samples. Water quality stations where triplicate sampling was conducted were chosen on a predetermined rotational basis to ensure that triplicates were collected at different stations over a one year sampling period in the basin. As a result, thirty-one sets of triplicate sampling data are available for the 1984-1985 sampling period in the International Saint John River Basin. The results of triplicate sampling and their implications with regard to monitoring for water quality objectives using grab sampling techniques in the basin are discussed below.

Results of "Field Blanks" and "Filter Blanks"

Tables 3 and 4 indicate the analytical results of the "field" and "filter" blanks prepared during the 1984-1985 monitoring period in the International Saint John Basin.

The "field blank" results were all below the detection limit of the analytical method employed to analyze for extractable aluminum, copper, lead, and mercury. However, roughly 20% of the "field blanks" analyzed for total phosphorus were found to have

TABLE 3 . Field Blank Results For International Saint John River Basin Sampling 1984-1985

SAMPLING DATE	Al.- EXT. 13305P	PHOS.-TOTAL 15413P	Zn - EXT. 30304P	Cu - EXT. 29305P	Pb - EXT. 82302P	Hg - EXT. 80315P
31-JAN-84		0.002	(0.01	(0.002		
31-JAN-84		(0.001	(0.01	(0.002		
02-FEB-84		(0.001	(0.01	(0.002		
02-APR-84		(0.001	(0.01	(0.002	(0.002	
03-APR-84		(0.001	(0.01	(0.002	(0.002	
04-APR-84		(0.001	(0.01	(0.002	(0.002	
15-MAY-84	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
16-MAY-84	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
17-MAY-84	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
26-JUN-84	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
28-JUN-84	(0.01	0.001	(0.01	(0.002	(0.002	(0.02
04-JUL-84	(0.01		(0.01	(0.002	(0.002	
13-AUG-84			0.01	(0.002	(0.002	(0.02
14-AUG-84	(0.01		0.01	(0.002	(0.002	(0.02
15-AUG-84	(0.01	(0.001	0.01	(0.002	(0.002	
16-AUG-84	(0.01		0.01	(0.002	(0.002	(0.02
29-OCT-84	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
30-OCT-84	(0.01	0.003	(0.01	(0.002	(0.002	(0.02
03-DEC-84		(0.001				(0.02
04-DEC-84	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
05-DEC-84	(0.01	(0.001	(0.01	0.002	(0.002	(0.02
28-JAN-85	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
29-JAN-85	(0.01	0.001	(0.01	(0.002	(0.002	(0.02
30-JAN-85	(0.01	0.005	(0.01	(0.002	(0.002	(0.02
13-MAY-85	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
14-MAY-85	(0.01	0.016	(0.01	(0.002	(0.002	(0.02
17-JUN-85	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
18-JUN-85	(0.01	0.005	(0.01	(0.002	(0.002	(0.02
13-AUG-85		(0.001				(0.02
14-AUG-85	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
15-AUG-85	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
19-NOV-85	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
20-NOV-85	(0.01	(0.001	(0.01	(0.002	(0.002	
17-DEC-85	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02
18-DEC-85	(0.01	(0.001	(0.01	(0.002	(0.002	(0.02

TABLE 4 . Filter blanks for Dissolved Aluminum and Dissolved Phosphorus

SAMPLING DATE	Millipore 0.45 um Membrane Filters Diss. Al.	Gelman Spectro-grade Filters Diss. P
31-JAN-84	(0.010	
31-JAN-84	(0.010	
02-FEB-84	(0.010	
02-APR-84	(0.010	(0.001
03-APR-84	(0.010	(0.001
04-APR-84	(0.010	
15-MAY-84	(0.010	(0.001
16-MAY-84	(0.010	(0.001
17-MAY-84	(0.010	(0.001
26-JUN-84	(0.010	
28-JUN-84		(0.001
04-JUL-84		0.004
14-AUG-84	(0.010	0.002
15-AUG-84	(0.010	(0.001
16-AUG-84	(0.010	0.003
29-OCT-84	(0.010	(0.001
30-OCT-84	(0.010	(0.001
03-DEC-84	(0.010	(0.00i
04-DEC-84	(0.010	(0.001
05-DEC-84	(0.010	(0.001
28-JAN-85	(0.010	(0.001
29-JAN-85	(0.010	(0.001
30-JAN-85	(0.010	(0.001
13-MAY-85	(0.010	(0.001
14-MAY-85	(0.010	(0.001
17-JUN-85	(0.010	(0.001
18-JUN-85	(0.010	
14-AUG-85		(0.001
15-AUG-85		(0.001
19-NOV-85	(0.010	(0.001
20-NOV-85	(0.010	(0.001
17-DEC-85	(0.010	(0.001
18-DEC-85	(0.010	(0.001

levels above the analytical detection limit, with values ranging as high as 0.016 mg/l. Because water samples collected on the same day as the "field blanks" were prepared often had levels of total phosphorus well below the level found in the "field blank", it would seem that this problem of phosphorus contamination in "field blanks" might stem from the sample bottles themselves. The current practice is to wash the glass bottles in which samples are collected for phosphorus analysis using chromic acid. To prevent phosphorus contamination due to its absorption onto the walls of the glass bottles, it is recommended that the washing procedure for the glass bottles be changed to washing with hot dilute HCl.

The other parameter for which field blanks were found to have positive values was extractable zinc during the August 1984 sampling week. The values measured were at the detection limit of the analytical method (0.010 mg/l), and all field blanks and samples collected on August 13, 14, 15 and 16 were found to have extractable zinc concentrations at the 0.010 mg/l level. Hence, it appears that, during the August 1984 sampling week, the nitric acid used to preserve water samples was contaminated with zinc at the limit of detection of the analytical method.

All of the filter blanks for the Millipore 0.45 um membrane filters used to filter samples for dissolved aluminum were found to be below the detection limit of the analytical method (0.010 mg/l), leading one to conclude that the present washing method for the membrane filters is satisfactory in preventing contamination from

the filters.

However, a few of the filter blanks for dissolved phosphorus were found to contain phosphorus levels above the analytical detection limit, with levels ranging up to 0.004 mg/l. Here again, this contamination may be due to carry-over in the glass bottles.

Results of Triplicate Sampling

Table 5 indicates the analytical results for pH, extractable aluminum, dissolved aluminum, total phosphorus and dissolved total phosphorus for all samples collected in triplicate in the International Saint John Basin during the 1984-85 sampling period. Also included in the table are the arithmetic mean of the parameter values for the three replicates, the standard deviation of the parameter values and the coefficient of variation, where

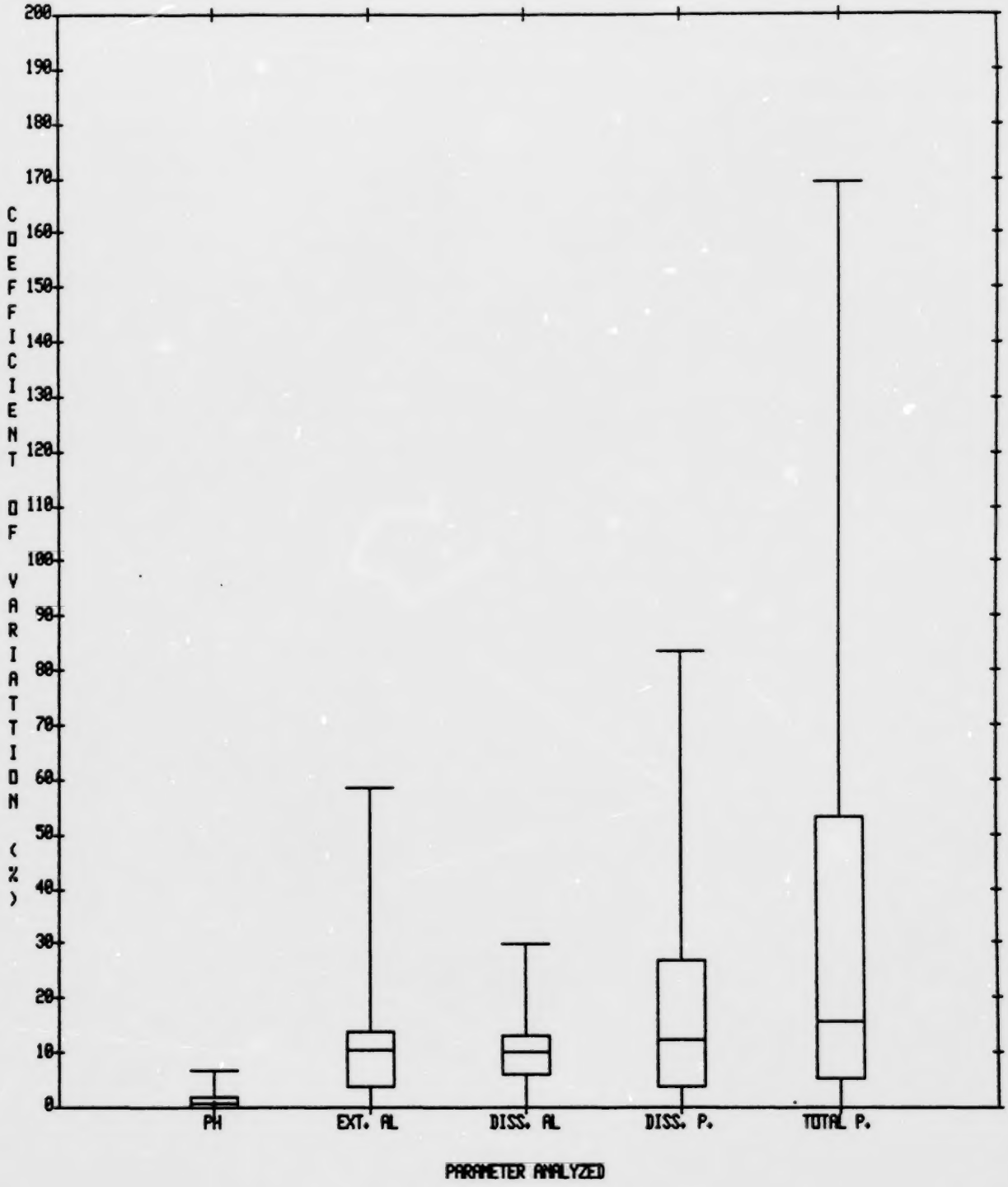
$$\text{coefficient of variation} = \frac{\text{standard deviation}}{\text{mean}} \times 100$$

The coefficient of variation was chosen as a measure of variability between the replicate sample values because it is a measure independent of units, and because the analytical precision of many of the analytical methods is expressed in this manner.

Figure 2 indicates the minimum, 25th percentile, median, 75th percentile and maximum coefficients of variation of the triplicate samples for pH (lab measured), extractable aluminum, dissolved

Fig. 2

COEFFICIENTS OF VARIATION OF TRIPLICATE SAMPLES
INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985



aluminum, total phosphorus and total dissolved phosphorus.

If the median coefficient of variation is taken as the average variability among replicates for the sampling period, it is apparent that, on the average, the measurement precision for the different parameters is as follows:

pH (lab measured) - ± 1%
extractable aluminum - ± 10%
dissolved aluminum - ± 10%
total phosphorus - ± 12%
dissolved total phosphorus - ± 15%

However, the important thing to note for our purpose, where single grab sample values are to be compared to an acute level, is not the average repeatibility of the data gathering process, but the extremes of variability which can result from single grab samples. Figure 2 indicates that at times the variability between replicates can be as high as:

± 8% for pH (lab measured)
± 58% for extractable aluminum
± 30% for dissolved aluminum
± 170% for total phosphorus
± 80% for dissolved total phosphorus

Undoubtedly, a great deal of the high variability between

TABLE 5 . Results of triplicate sampling in International Saint John Basin 1984-1985

SAMPLING STA. NO.	SAMPLING DATE	SAMPLING TIME	LAB pH	EXT. Al	DISS. Al	DISS. PHOS.	TOTAL PHOS.
00NB01AD0001	27-MAR-85	1345	7.0	0.072	0.064	0.005	0.014
00NB01AD0001	27-MAR-85	1350	6.9	0.063	0.061		0.003
00NB01AD0001	27-MAR-85	1355	6.9	0.070	0.061		0.006
MEAN			6.93	0.068	0.062	0.005	0.008
S.D.			0.06	0.005	0.002		0.006
C.V.%			0.8	6.9	2.8		74.0
00NB01AD0008	05-DEC-84	1520		0.093		0.006	0.011
00NB01AD0008	05-DEC-84	1525		0.090			
00NB01AD0008	05-DEC-84	1530		0.100			0.008
MEAN				0.094		0.006	0.010
S.D.				0.005			0.002
C.V.%				5.4			22.0
00NB01AD0009	05-DEC-84	945	7.3	0.025	0.012	0.001	0.002
00NB01AD0009	05-DEC-84	950	7.3	0.021	0.012	0.001	0.001
00NB01AD0009	05-DEC-84	955	7.3	0.025	0.010		0.001
MEAN			7.3	0.024	0.011	0.001	0.001
S.D.			0.0	0.002	0.001	0.0	0.001
C.V.%			0.0	9.8	10.0	0.0	43.0
00NB01AD0013	27-MAR-85	940	7.5	0.020	0.018	0.001	0.001
00NB01AD0013	27-MAR-85	945	7.5	0.025	0.013		0.001
00NB01AD0013	27-MAR-85	950	7.5	0.028	0.018		0.001
MEAN			7.5	0.024	0.016	0.001	0.001
S.D.			0.0	0.004	0.003		0.0
C.V.%			0.0	17.0	18.0		0.0
00NB01AD0017	27-FEB-85	1445	7.3	0.024	0.019	0.007	0.006
00NB01AD0017	27-FEB-85	1450	7.0	0.029	0.022	0.007	0.008
00NB01AD0017	27-FEB-85	1455	7.0	0.030	0.018	0.007	0.007
MEAN			7.1	0.028	0.020	0.007	0.007
S.D.			0.17	0.003	0.002	0.0	0.001
C.V.%			2.4	12.0	11.0	0.0	14.0
00NB01AD0019	30-OCT-84	1735	7.7	0.015	0.010	0.001	0.008
00NB01AD0019	30-OCT-84	1740	7.7	0.017	0.010		
00NB01AD0019	30-OCT-84	1731	7.9	0.020	0.010	0.002	0.008
MEAN			7.77	0.017	0.010	0.001	0.008
S.D.			0.12	0.003	0.0	0.001	0.0
C.V.%			1.49	15.0	0.0	48.0	0.0
00NB01AD0019	05-DEC-84	1430	7.4	0.032	0.010		0.004
00NB01AD0019	05-DEC-84	1431	7.5	0.016	0.010	0.001	0.013
00NB01AD0019	05-DEC-84	1432	7.7	0.019	0.010	0.001	0.005
MEAN			7.53	0.022	0.010	0.001	0.007
S.D.			0.15	0.009	0.0	0.0	0.005
C.V.%			2.03	38.0	0.0	0.7	67.0

TABLE 5 . Results of triplicate sampling in International Saint John Basin 1984-1985

SAMPLING STA. NO.	SAMPLING DATE	SAMPLING TIME	LAB pH	EXT. Al	DISS. Al	DISS. PHOS.	TOTAL PHOS.
00NB01AD0031	27-FEB-85	1330	6.9	0.130	0.051	0.026	0.046
00NB01AD0031	27-FEB-85	1335	6.5	0.160	0.055	0.026	
00NB01AD0031	27-FEB-85	1340	7.0	0.150	0.042	0.025	0.047
MEAN			6.8	0.147	0.049	0.026	0.043
S.D.			0.26	0.015	0.007	0.001	0.007
C.V.%			3.9	10.0	13.0	2.2	16.0
00NB01AD0031	27-MAR-85	1145	7.1	0.072	0.050	0.003	0.007
00NB01AD0031	27-MAR-85	1150	7.1	0.075	0.057		0.003
00NB01AD0031	27-MAR-85	1155	7.1	0.075	0.064		0.003
MEAN			7.1	0.074	0.057	0.003	0.004
S.D.			0.0	0.002	0.007		0.002
C.V.%			0.0	2.3	12.0		53.0
00NB01AF0014	29-JAN-85	1000	7.8	0.012		0.001	0.002
00NB01AF0014	29-JAN-85	1005	7.8	0.015		0.001	0.004
00NB01AF0014	29-JAN-85	1010	7.8	0.012		0.001	0.002
MEAN			7.8	0.013		0.001	0.003
S.D.			0.0	0.002		0.0	0.001
C.V.%			0.0	13.0		0.0	43.0
00NB01AF0015	30-JAN-85	1550	7.4	0.010		0.001	0.002
00NB01AF0015	30-JAN-85	1555	7.4	0.010		0.001	0.002
00NB01AF0015	30-JAN-85	1600	7.7	0.010		0.001	0.002
MEAN			7.5	0.010		0.001	0.002
S.D.			0.17	0.0		0.0	0.0
C.V.%			2.3	0.0		0.0	0.0
00NB01AF0019	29-JAN-85	1300	7.4	0.019		0.003	0.007
00NB01AF0019	29-JAN-85	1305	7.6	0.010		0.005	0.007
00NB01AF0019	29-JAN-85	1310	7.4	0.012		0.005	0.007
MEAN			7.47	0.014		0.004	0.007
S.D.			0.12	0.005		0.001	0.0
C.V.%			1.6	35.0		27.0	0.0
00NB01AF0038	26-FEB-85	1415	6.8	0.240	0.200	0.042	
00NB01AF0038	26-FEB-85	1420	6.6	0.200	0.170	0.042	0.047
00NB01AF0038	26-FEB-85	1425	6.7	0.190	0.160	0.041	0.041
MEAN			6.7	0.210	0.177	0.042	0.044
S.D.			0.10	0.026	0.021	0.001	0.004
C.V.%			1.5	13.0	12.0	1.4	9.6
00NB01AB0003	14-AUG-84	1115	8.0	0.036	0.015	0.005	0.011
00NB01AB0003	14-AUG-84	1125	8.0	0.033	0.014	0.004	0.012
00NB01AB0003	14-AUG-84	1120	8.0	0.035	0.016	0.005	0.011
MEAN			8.0	0.035	0.015	0.005	0.011
S.D.			0.0	0.002	0.001	0.001	0.001
C.V.%			0.0	4.4	6.7	12.0	5.1

TABLE 5 . Results of triplicate sampling in International Saint John Basin 1984-1985

SAMPLING STA. NO.	SAMPLING DATE	SAMPLING TIME	LAB pH	EXT. Al	DISS. Al	DISS. PHOS.	TOTAL PHOS.
00NB01AJ0012	29-OCT-84	1300	8.4	0.010	0.010	0.003	0.010
00NB01AJ0012	29-OCT-84	1305	8.3	0.010	0.010	0.003	0.010
00NB01AJ0012	29-OCT-84	1310	8.3	0.010	0.010	0.006	0.009
MEAN			8.33	0.010	0.010	0.004	0.010
S.D.			0.06	0.000	0.000	0.002	0.001
C.V.%			0.7	0.0	0.0	43.0	6.0
00NB01AJ0012	13-MAY-85	1330	7.9	0.031	0.010	0.010	0.017
00NB01AJ0012	13-MAY-85	1340	7.8	0.025	0.010	0.008	0.017
00NB01AJ0012	13-MAY-85	1350	7.7	0.028	0.010	0.007	0.017
MEAN			7.8	0.028	0.010	0.008	0.017
S.D.			0.10	0.003	0.000	0.002	0.000
C.V.%			1.3	11.0	0.0	18.0	0.0
00NB01AJ0012	17-JUN-85	1420	7.9	0.010	0.010	0.010	0.025
00NB01AJ0012	17-JUN-85	1415	8.0	0.010	0.010	0.015	0.023
00NB01AJ0012	17-JUN-85	1410	7.8	0.010	0.010	0.019	0.019
MEAN			7.9	0.010	0.010	0.015	0.022
S.D.			0.10	0.000	0.000	0.005	0.003
C.V.%			1.3	0.0	0.0	31.0	14.0
00NB01AJ0029	29-OCT-84	1130	8.0	0.010	0.010	0.001	0.005
00NB01AJ0029	29-OCT-84	1135	8.1	0.010	0.010	0.001	0.005
00NB01AJ0029	29-OCT-84	1140	7.9	0.010	0.010	0.001	0.004
MEAN			8.0	0.010	0.010	0.001	0.005
S.D.			0.10	0.000	0.000	0.000	0.001
C.V.%			1.3	0.0	0.0	0.0	12.0
00NB01AJ0029	13-MAY-85	1150	7.7	0.037	0.020	0.008	0.017
00NB01AJ0029	13-MAY-85	1201	7.8	0.034	0.022	0.007	0.012
00NB01AJ0029	13-MAY-85	1210	7.8	0.030	0.020		0.014
MEAN			7.77	0.034	0.021	0.008	0.014
S.D.			0.06	0.004	0.001	0.001	0.003
C.V.%			0.8	10.0	5.6	9.4	18.0
01NB01AF0005	14-AUG-84	1500	7.4	0.065	0.030	0.006	0.020
01NB01AF0005	14-AUG-84	1505	7.4	0.062	0.025	0.005	0.014
01NB01AF0005	14-AUG-84	1510	7.4	0.065	0.016	0.005	0.013
MEAN			7.4	0.064	0.024	0.005	0.016
S.D.			0.0	0.002	0.007	0.001	0.004
C.V.%			0.0	2.7	30.0	11.0	24.0
01NB01AG0001	14-AUG-84	945	7.8	0.045	0.030	0.013	0.029
01NB01AG0001	14-AUG-84	950	7.7	0.043	0.030	0.012	0.030
01NB01AG0001	14-AUG-84	955	7.5	0.041	0.025	0.013	0.030
MEAN			7.67	0.043	0.028	0.013	0.030
S.D.			0.15	0.002	0.003	0.001	0.001
C.V.%			2.0	4.7	10.0	4.6	2.0

TABLE 5 . Results of triplicate sampling in International Saint John Basin 1984-1985

SAMPLING STA. NO.	SAMPLING DATE	SAMPLING TIME	LAB pH	EXT. Al	DISS. Al	DISS. PHOS.	TOTAL PHOS.
01NB01AG0001	17-JUN-85	1535	7.3	0.050	0.050	0.030	0.042
01NB01AG0001	17-JUN-85	1540	7.3	0.050	0.050	0.032	0.042
01NB01AG0001	17-JUN-85	1530	7.2	0.050	0.040	0.030	0.042
MEAN			7.27	0.050	0.047	0.031	0.042
S.D.			0.06	0.000	0.006	0.001	0.000
C.V.%			0.8	0.0	12.0	3.8	0.0
00NB01AD0013	16-MAY-84	1210	6.7	0.095	0.040	0.002	0.009
00NB01AD0013	16-MAY-84	1205	7.6	0.120	0.035	0.003	0.010
00NB01AD0013	16-MAY-84	1201	7.5	0.110	0.037	0.003	0.014
MEAN			7.27	0.108	0.037	0.003	0.011
S.D.			0.49	0.013	0.003	0.001	0.003
C.V.%			6.8	12.0	6.7	22.0	24.0
00NB01AD0016	17-MAY-84	1220	7.2	0.040	0.010	0.001	0.008
00NB01AD0016	17-MAY-84	1230	7.2	0.040	0.010	0.001	0.009
00NB01AD0016	17-MAY-84	1210	7.1	0.040	0.010	0.001	0.009
MEAN			7.17	0.040	0.010	0.001	0.009
S.D.			0.06	0.000	0.000	0.000	0.001
C.V.%			0.81	0.0	0.000	0.0	6.7
00NB01AD0017	16-MAY-84	1415	6.7	0.130	0.070	0.008	1.000
00NB01AD0017	16-MAY-84	1420	6.7	0.150	0.077	0.003	0.007
00NB01AD0017	16-MAY-84	1425	6.7	0.120	0.067	0.002	0.008
MEAN			6.7	0.133	0.071	0.004	0.338
S.D.			0.00	0.015	0.005	0.003	0.573
C.V.%			0.00	11.0	7.2	74.0	169.0
00NB01AF0002	26-JUN-84	1615	7.3	0.050	0.050	0.006	0.015
00NB01AF0002	26-JUN-84	1620	7.0	0.050	0.050	0.009	0.012
00NB01AF0002	26-JUN-84	1625	7.2	0.050	0.050	0.006	0.014
MEAN			7.17	0.050	0.050	0.007	0.014
S.D.			0.15	0.000	0.000	0.002	0.002
C.V.%			2.1	0.0	0.0	25.0	11.0
00NB01AF0023	27-JUN-84	1045	7.2	0.100	0.100	0.009	4.000
00NB01AF0023	27-JUN-84	1050	7.2	0.090	0.090	0.011	0.052
00NB01AF0023	27-JUN-84	1055	7.2	0.100	0.100	0.009	0.070
MEAN			7.2	0.097	0.097	0.010	1.374
S.D.			0.00	0.006	0.006	0.001	2.274
C.V.%			0.00	6.0	6.0	12.0	166.0
00NB01AD0013	18-DEC-85	1201	7.5	0.017	0.010	0.004	0.017
00NB01AD0013	18-DEC-85	1205	7.4	0.021	0.010	0.003	0.004
00NB01AD0013	18-DEC-85	1210	7.4	0.045	0.010	0.003	0.007
MEAN			7.43	0.028	0.010	0.003	0.009
S.D.			0.06	0.015	0.000	0.001	0.007
C.V.%			0.8	55.0	0.0	17.0	73.0

TABLE 5 . Results of triplicate sampling in International Saint John Basin 1984-1985

SAMPLING STA. NO.	SAMPLING DATE	SAMPLING TIME	LAB pH	EXT. Al	DISS. Al	DISS. PHOS.	TOTAL PHOS.
00NB01AF0021	27-JUN-84	1145	7.5	0.030	0.030	0.001	0.006
00NB01AF0021	27-JUN-84	1150	7.5	0.020	0.020	0.007	0.022
00NB01AF0021	27-JUN-84	1155	7.5	0.020	0.020	0.003	0.009
MEAN			7.5	0.023	0.023	0.004	0.009
S.D.			0.0	0.0			
C.V.%			0.0	25.0	25.0	83.0	69.0
00NB01AF0021	20-NOV-85	815	7.8	0.010	0.010	0.001	0.001
00NB01AF0021	20-NOV-85	820	7.6	0.010	0.010	0.001	0.001
00NB01AF0021	20-NOV-85	825	7.5	0.025	0.010	0.001	0.001
MEAN			7.63	0.015	0.010	0.001	0.001
S.D.			0.15	0.009	0.000	0.000	0.000
C.V.%			2.0	58.0	0.0	0.0	0.0
00NB01AF0038	20-NOV-85	915	7.0	0.073	0.055	0.010	0.024
00NB01AF0038	20-NOV-85	920	7.0	0.071	0.055	0.011	0.020
00NB01AF0038	20-NOV-85	925	7.0	0.071	0.069	0.011	0.017
MEAN			7.0	0.072	0.060	0.011	0.020
S.D.			0.00	0.001	0.008	0.001	0.004
C.V.%			0.0	1.6	14.0	5.4	17.0

replicates is caused by the inadequacy of single grab samples to fully represent a non-homogeneous water mass. This is particularly true in the case of total phosphorus, where it is evident that the incidence of high variability among replicates coincide with peaks on the hydrograph, when run-off is high and the water is turbid.

Regardless of the cause of the sometimes high variability between replicates, the data does indicate the need for caution when comparing individual grab sample values to the "acute" water quality objectives.

Figures 3 to 15 are box and whisker plots of dissolved oxygen (mg/L), dissolved oxygen (% saturation), pH (lab measured), pH (field measured), extractable aluminum, dissolved aluminum, total phosphorus, total dissolved phosphorus, extractable copper, extractable lead, extractable zinc, extractable mercury and non-filterable residue measured at the twenty water quality sampling stations during the 1984-1985 sampling period.

Tables 6 to 18 list the summary statistics for all parameter values measured at each sampling station during the 1984-1985 sampling period, i.e.: the minimum and maximum levels measured, the arithmetic mean level, the median level, the total number of sample measurements made at each site, and whether or not the parameter values met the water quality objective for the parameter at each sampling site.

Fig. 3

DISSOLVED OXYGEN AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

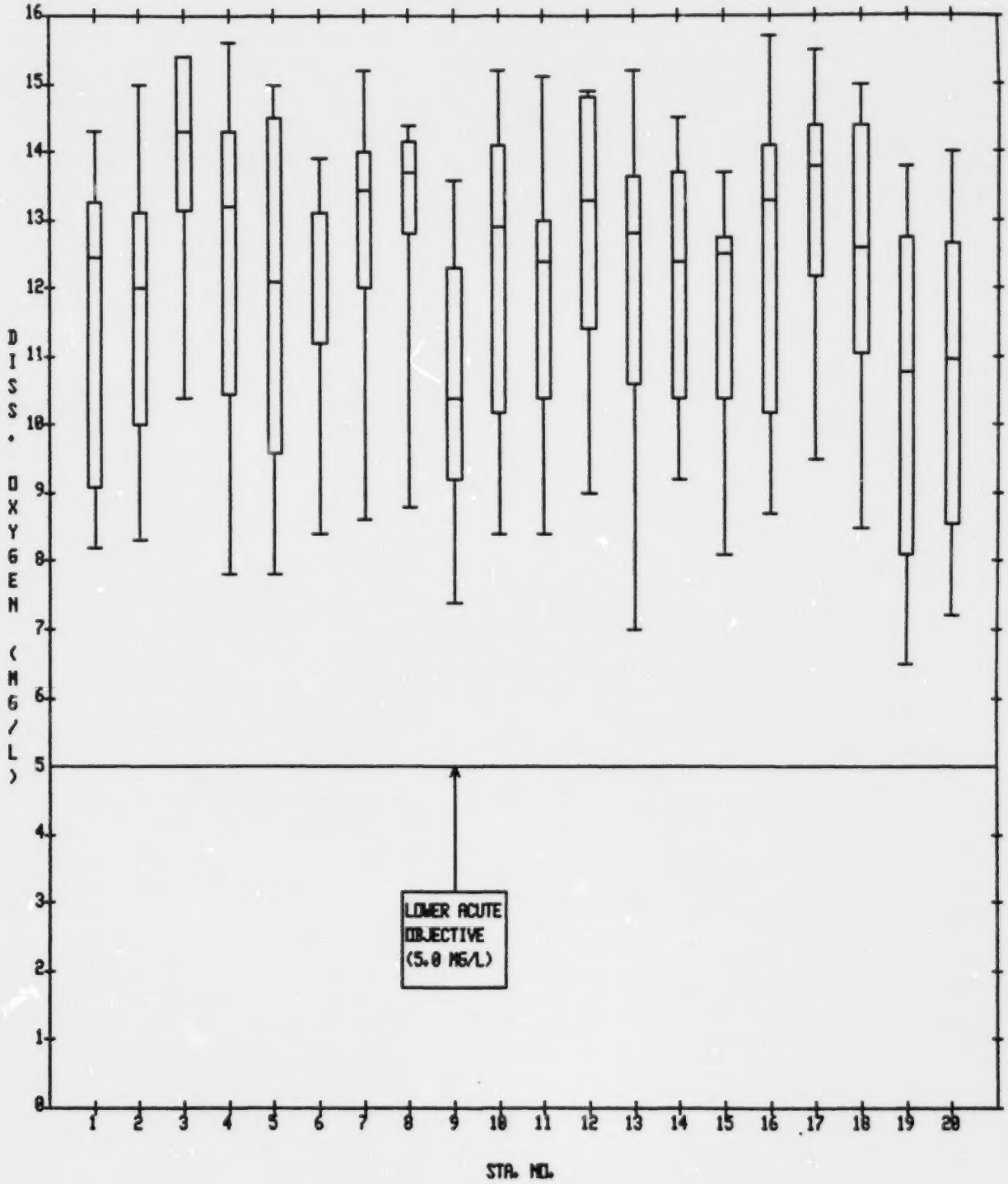


Table 6

Summary Data

Dissolved Oxygen (mg/l)

No.	Location	Min.	Max.	Mean	Median	N.	Acute
1.	S.J.R. at Clair	8.2	14.3	11.5	12.5	12	N
2.	S.J.R. at Edmundston	8.3	15.0	11.7	12.0	10	N
3.	Little R. at hwy 205	10.4	15.4	14.0	14.3	9	N
4.	St. Francis R.	7.8	15.6	12.5	13.2	17	N
5.	Madawaska R.	7.8	15.0	12.1	12.1	11	N
6.	S.J.R. at Caron Brook	8.4	13.9	12.1	13.1	10	N
7.	Baker Brook at Baker Brook	8.6	15.2	12.6	13.5	10	N
8.	S.J.R. at St. Francis, Me.	8.8	14.4	13.0	13.7	12	N
9.	S.J.R. at St. Leonard	7.4	13.6	10.6	10.4	11	N
10.	Seigas R. at Seigas	8.4	15.2	12.4	12.9	7	N
11.	Quisbis R. at T.C.H.	8.4	15.1	12.0	12.4	7	N
12.	Iroquois R. at hwy	9.0	14.9	12.9	13.3	8	N
13.	Green R. at W.S.C. Gauge	7.0	15.2	12.1	12.8	17	N
14.	Grand R. at T.C.H.	9.2	14.5	11.9	12.4	12	N
15.	S.J.R. at St. Basile	8.1	13.7	11.9	12.5	13	N
16.	Limestone Str. at W.S.C. Gauge	8.7	15.7	12.4	13.3	16	N
17.	Big Presquile Str. at border	9.5	15.5	13.4	13.8	17	N
18.	Meduxnekeag R. at Belleville	8.5	15.0	12.5	12.6	17	N
19.	S.J.R. at Grand Falls	6.5	13.8	10.5	10.8	17	N
20.	Aroostrook R. at Tinker Dam	7.2	14.0	10.6	10.95	16	N

Fig. 4
DISSOLVED OXYGEN (% SATURATION) AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

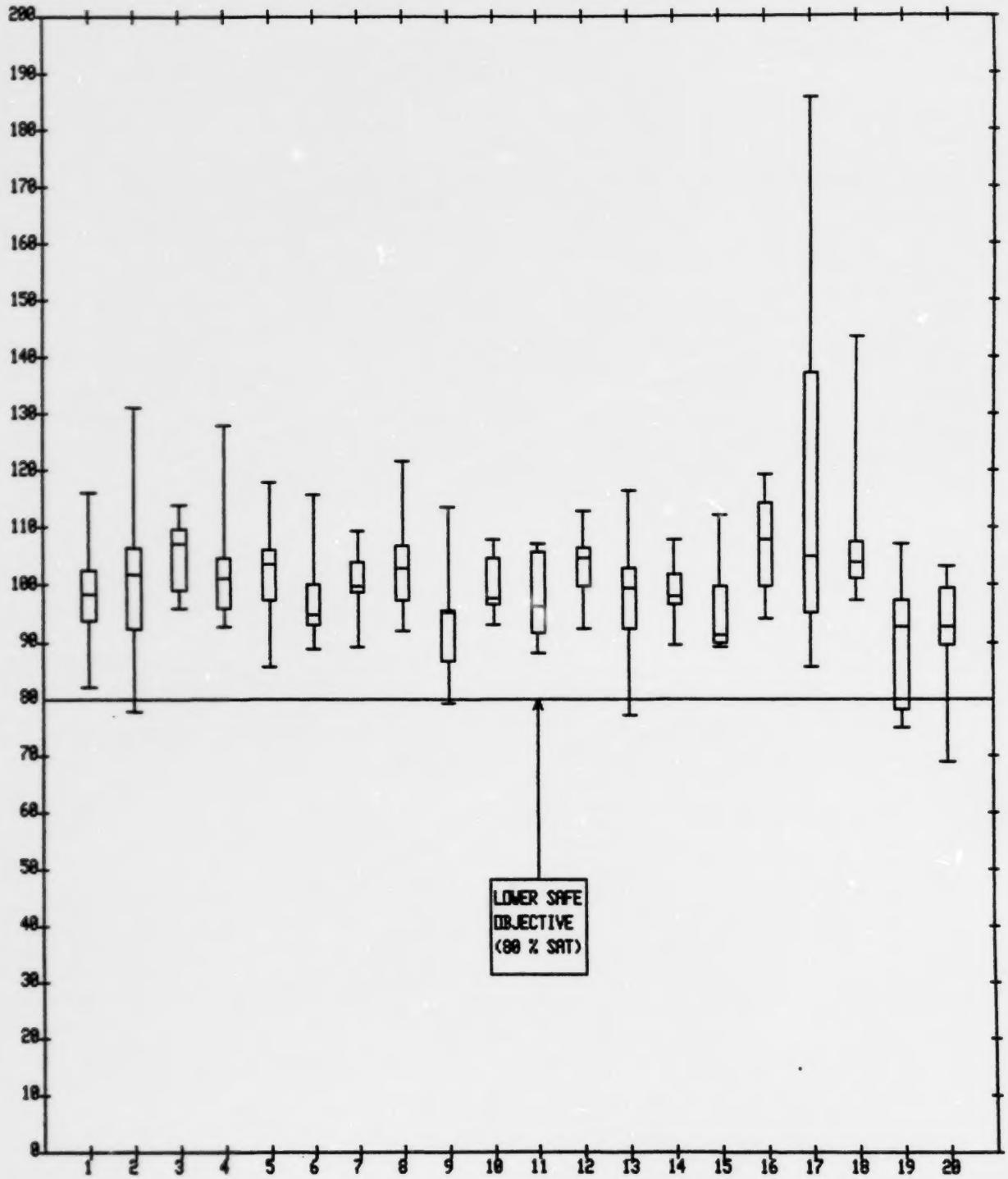


Table 7

Summary Data

Dissolved Oxygen (% Sat)

No.	Location	Min.	Max.	Mean	Median	N.	Safe
1.	S.J.R. at Clair	81.9	116.1	98.7	98.2	16	Y
2.	S.J.R. at Edmundston	77.7	131.2	100.9	101.8	14	N
3.	Little R. at hwy 205	95.9	114.0	105.4	107.2	13	Y
4.	St. Francis R.	92.5	127.9	102.3	101.3	21	Y
5.	Madawaska R.	85.4	118.2	102.6	103.6	15	Y
6.	S.J.R. at Caron Brook	88.8	115.9	98.0	94.9	14	Y
7.	Baker Brook at Baker Brook	89.0	109.4	100.5	99.7	14	Y
8.	S.J.R. at St. Francis, Me.	92.1	121.4	102.9	103.1	16	Y
9.	S.J.R. at St. Leonard	79.1	113.9	92.9	95.2	10	N
10.	Seigas R. at Seigas	93.1	107.9	99.6	97.6	6	Y
11.	Quisbis R. at T.C.H.	88.1	107.2	97.0	96.1	6	Y
12.	Iroquois R. at hwy	92.3	112.9	103.4	104.6	7	Y
13.	Green R. at W.S.C. Gauge	76.9	116.4	98.8	99.6	13	N
14.	Grand R. at T.C.H.	89.5	107.9	98.9	97.9	11	Y
15.	S.J.R. at St. Basile	89.2	112.3	95.8	91.3	10	Y
16.	Limestone Str. at W.S.C. Gauge	94.2	119.3	107.3	108.1	11	Y
17.	Big Presquile Str. at border	85.4	185.8	116.7	105.3	10	Y
18.	Meduxnekeag R. at	97.3	143.8	106.6	104.1	10	Y
19.	S.J.R. at Grand Falls	74.8	107.2	90.0	92.7	12	N
20.	Aroostook R. at Tinker Dam	68.9	103.2	92.4	92.7	12	N

Dissolved Oxygen (mg/L) / % Oxygen Saturation

Figure 3 indicates the minimum, 25th percentile value, median, 75th percentile value and the maximum values of dissolved oxygen measured at the twenty sampling sites over the 1984-1985 sampling period. Table 6 lists the summary statistics for this parameter at each of the twenty sampling sites over the 1984-1985 sampling period, and indicates that no sample violated the "acute" level, i.e.: no single sample had <5.0 mg/L dissolved oxygen. The lowest dissolved oxygen concentration measured was 6.5 mg/L in the Grand Falls headpond on August 14, 1985.

Figure 4 is a box and whisker plot of oxygen % saturation measured at the twenty sampling sites over the two year sampling period. Table 7 lists the summary statistics for this parameter at each of the twenty sampling sites, and indicates that, although all sample means and medians met the water quality objective of >80% saturation, individual measurements violated the objective at the following sampling stations with the following frequency:

Sta. No. 2 - Saint John River at Edmundston - one measurement on Jan. 29/85 - 77.7%

Sta. No. 9 - Saint John River at St. Leonard - one measurement on Mar. 26/85 - 79.1%

Sta. No. 13 - Green River at W.S.C. Gauge - one measurement on Aug. 14/85 - 76.9%

Sta. No. 19 - Saint John River at Grand Falls - four measurements in total:
- one measurement on Jan. 28/85 - 77.4%
- one measurement on Feb. 28/85 - 74.8%
- one measurement on Mar. 26/85 - 76.3%

- one measurement on Aug. 14/85 - 78.4%

Sta. No. 20 - Aroostook River at Tinker Dam - one measurement on Jan. 28/85 - 68.9%

Figure 4 also indicates the extreme maximum values of this parameter which have been measured at Sta. No. 17 - the Big Presquile Stream at Can./U.S. border - during the sampling period. While no upper objective for the percent saturation relative to the wet atmosphere has been established for the International Saint John River Basin, it is known that percent saturation values above 110% may cause gas bubble disease in some species of fish. It is believed that the highly supersaturated (up to 185%) measurements made at this site during the 1984-1985 sampling period result from a slight change in field logistics which have resulted in field measurement and sampling at this site at roughly mid-afternoon, when the diel photosynthetic production of oxygen in the stream is at its peak.

pH

Figures 5 and 6 are box and whisker plots of pH (lab measured) and pH (field measured) respectively at the twenty water quality sampling stations for the two-year sampling period. Tables 8 and 9 contain the summary statistics for these two parameters.

Field measured pH exceeded the upper safe objective at the sampling station on the Big Presque Isle Stream on one occasion (Aug. 13/85). Generally, median pH was in the range of 7.1 - 7.7,

Fig. 5

PH (LAB MEASURED) AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

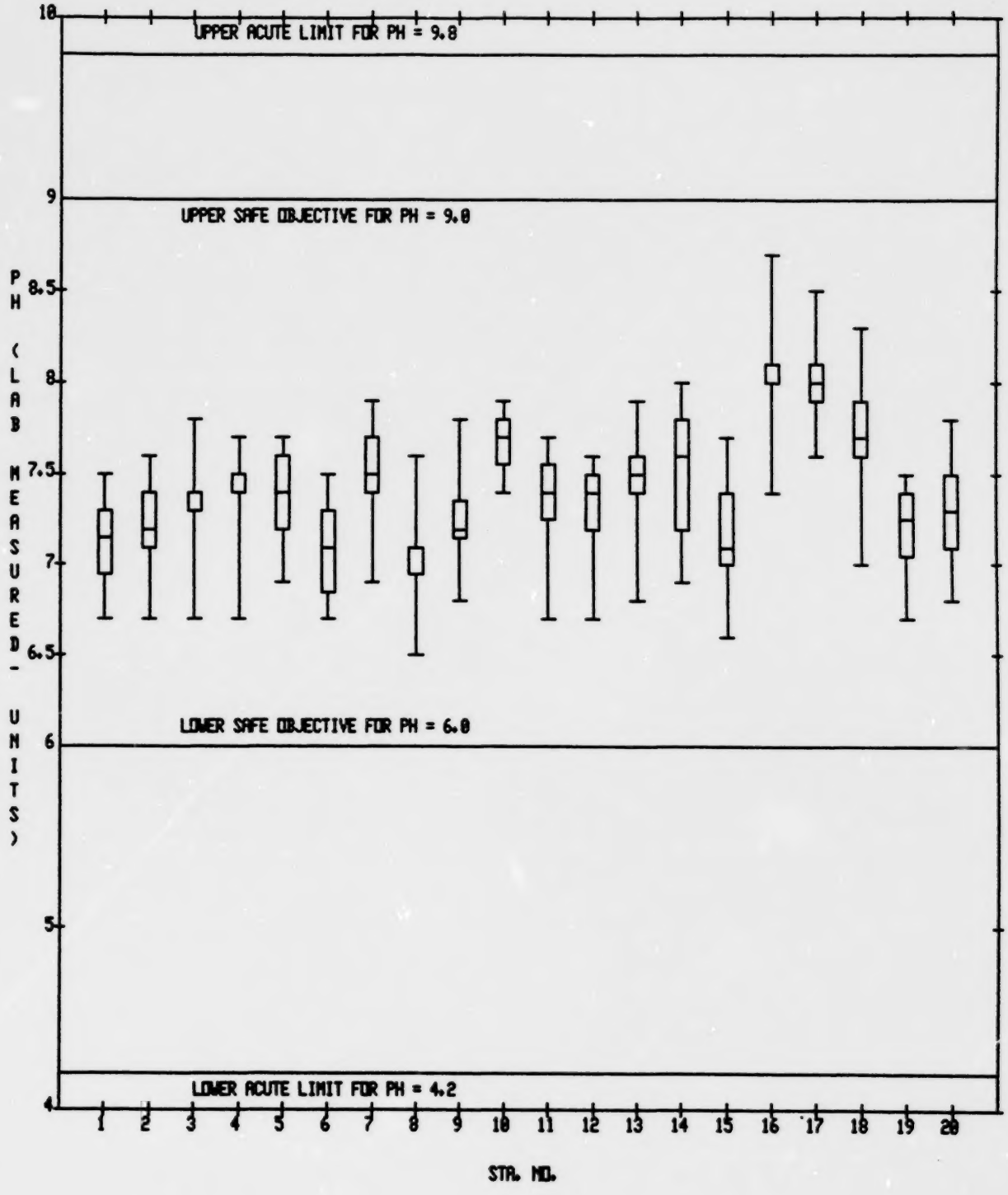


Table 8

Summary Data

pH (Lab Measured)

No.	Location	Min.	Max.	Mean	Median	N.	Safe	Acute
1.	S.J.R. at Clair	6.7	7.5	7.1	7.2	12	Y	Y
2.	S.J.R. at Edmundston	6.7	7.6	7.2	7.2	11	Y	Y
3.	Little R. at hwy 205	6.7	7.8	7.3	7.3	10	Y	Y
4.	St. Francis R.	6.7	7.7	7.4	7.5	21	Y	Y
5.	Madawaska R.	6.9	7.7	7.4	7.4	16	Y	Y
6.	S.J.R. at Caron Brook	6.7	7.5	7.1	7.1	13	Y	Y
7.	Baker Brook at Baker Brook	6.9	7.9	7.5	7.5	12	Y	Y
8.	S.J.R. at St. Francis, Me.	6.5	7.6	7.0	7.1	12	Y	Y
9.	S.J.R. at St. Leonard	6.8	7.8	7.2	7.2	12	Y	Y
10.	Seigas R. at Seigas	7.4	7.9	7.7	7.7	9	Y	Y
11.	Quisbis R. at T.C.H.	6.7	7.7	7.3	7.4	9	Y	Y
12.	Iroquois R. at hwy	6.7	7.6	7.3	7.4	10	Y	Y
13.	Green R. at W.S.C. Gauge	6.8	7.9	7.5	7.5	19	Y	Y
14.	Grand R. at T.C.H.	6.9	8.0	7.5	7.6	13	Y	Y
15.	S.J.R. at St. Basile	6.6	7.7	7.1	7.1	15	Y	Y
16.	Limestone R. at W.S.C. Gauge	7.4	8.7	8.0	8.0	16	Y	Y
17.	Big Presquile Str. at border	7.6	8.5	8.0	8.0	21	Y	Y
18.	Meduxnekeag R. at Belleville	7.0	8.3	7.7	7.7	19	Y	Y
19.	S.J.R. at Grand Falls	6.7	7.5	7.2	7.3	16	Y	Y
20.	Aroostook R. at Tinker Dam	6.8	7.8	7.3	7.3	19	Y	Y

Fig. 6

FIELD PH AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

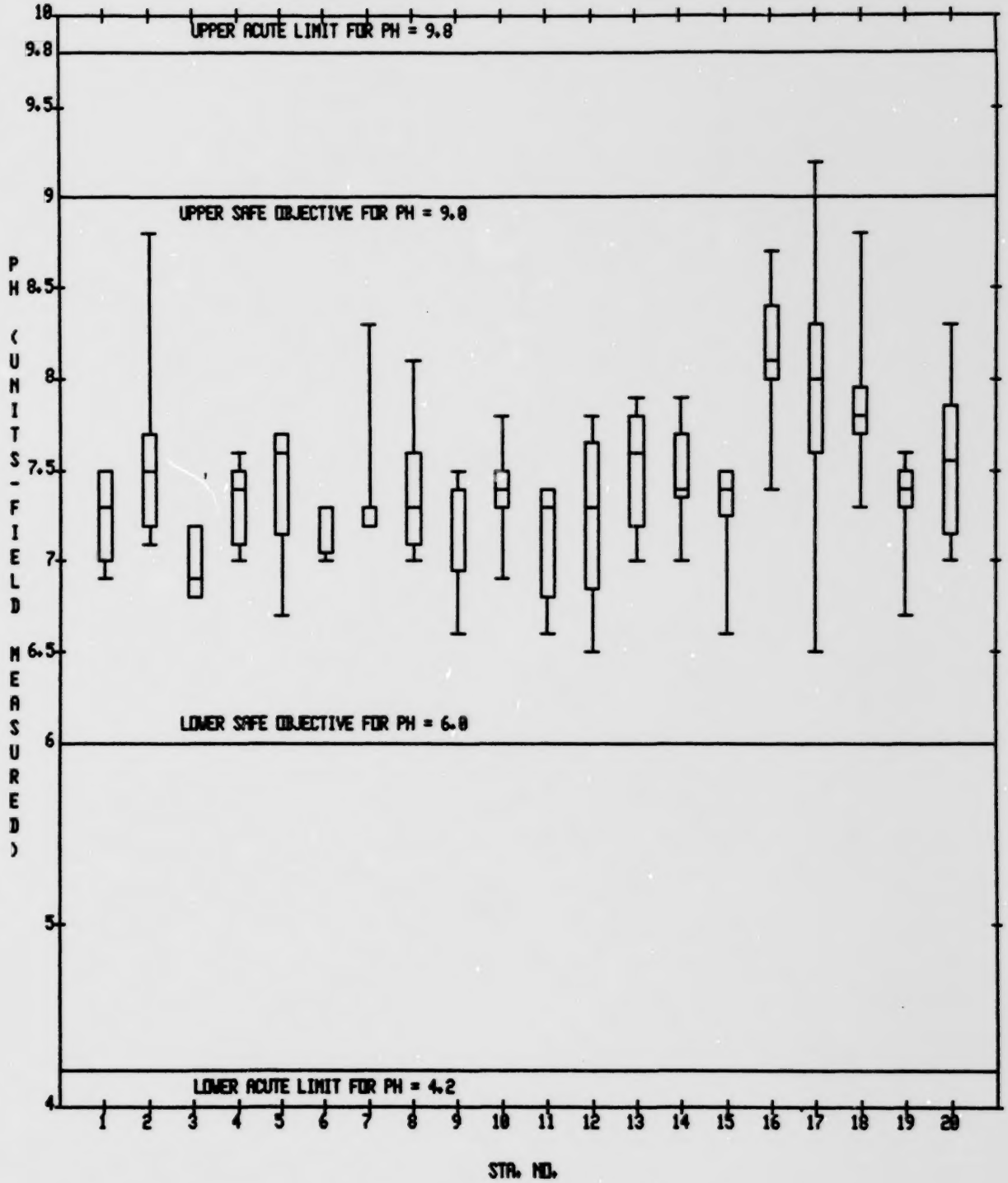


Table 9

Summary Data

pH (Field Measured)

No.	Location	Min.	Max.	Mean	Median	N.	Acute	Safe
1.	S.J.R. at Clair	6.9	7.5	7.3	7.3	7	Y	Y
2.	S.J.R. at Edmundston	7.1	8.8	7.6	7.5	7	Y	Y
3.	Little R. at hwy 205	6.8	7.2	7.0	6.9	6	Y	Y
4.	St. Francis R.	7.0	7.6	7.4	7.4	10	Y	Y
5.	Madawaska R.	6.7	7.7	7.4	7.6	9	Y	Y
6.	S.J.R. at Caron Brook	7.0	7.3	7.2	7.3	5	Y	Y
7.	Baker Brook at Baker Brook	7.2	8.3	7.4	7.2	6	Y	Y
8.	S.J.R. at St. Francis, Me.	7.0	8.1	7.4	7.3	6	Y	Y
9.	S.J.R. at St. Leonard	6.6	7.5	7.2	7.4	9	Y	Y
10.	Seigas R. at Seigas	6.9	7.8	7.4	7.4	6	Y	Y
11.	Quisbis R. at T.C.H.	6.6	7.4	7.1	7.3	5	Y	Y
12.	Iroquois R. at hwy	6.5	7.8	7.3	7.3	5	Y	Y
13.	Green R. at W.S.C. Gauge	7.4	7.9	7.5	7.6	11	Y	Y
14.	Grand R. at T.C.H.	7.0	7.9	7.5	7.4	9	Y	Y
15.	S.J.R. at St. Basile	6.6	7.5	7.3	7.4	8	Y	Y
16.	Limestone R. at W.S.C. Gauge	7.4	8.7	8.2	8.1	11	Y	Y
17.	Big Presquile Str. at border	6.5	9.2	8.0	8.0	11	Y	N
18.	Meduxnekeag R. at Belleville	7.3	8.8	7.9	7.8	12	Y	Y
19.	S.J.R. at Grand Falls	6.7	7.6	7.3	7.4	12	Y	Y
20.	Aroostook R. at Tinker Dam	7.0	8.3	7.5	7.6	12	Y	Y

with the stations on the International tributaries - Big Presque Isle Stream, Limestone River and Meduxnekeag River exhibiting higher median pH levels - in the 7.7 - 8.0 range. The high variability of pH in the Big Presque Isle Stream is indicative of divergence from equilibrium conditions as the result of photosynthesis in a highly productive system.

Extractable Aluminum (mg/L)

The median concentration of extractable aluminum was below the "safe" objective of 0.100 mg/L at all sampling sites. However, the mean concentration exceeded this objective at one site - the Saint John River at St. Basile. Seven of 15 samples collected from this site were found to have extractable aluminum concentrations above the 0.100 mg/L "safe" objective, with concentrations ranging up to 0.240 mg/L. A possible explanation for the higher levels of extractable aluminum found in samples from this site is its location, approximately 7 km downstream of the Fraser Inc. paper mill in Madawaska, Me, where alum is used in the paper making process (personal comm. D. Bishop). Measured losses of Al from the Madawaska Mill are in the order of 2-3 lbs/day.

Dissolved Aluminum (mg/L)

The "acute" limit for dissolved aluminum is between 1.0 mg/L and 5.0 mg/L, depending upon the stream pH. All of the stations sampled in the International Saint John River Basin had minimum pH

FIG. 7
EXTRACTABLE ALUMINUM AT TWENTY SAMPLING SITES
IN THE SAINT JOHN RIVER BASIN
1984-1985

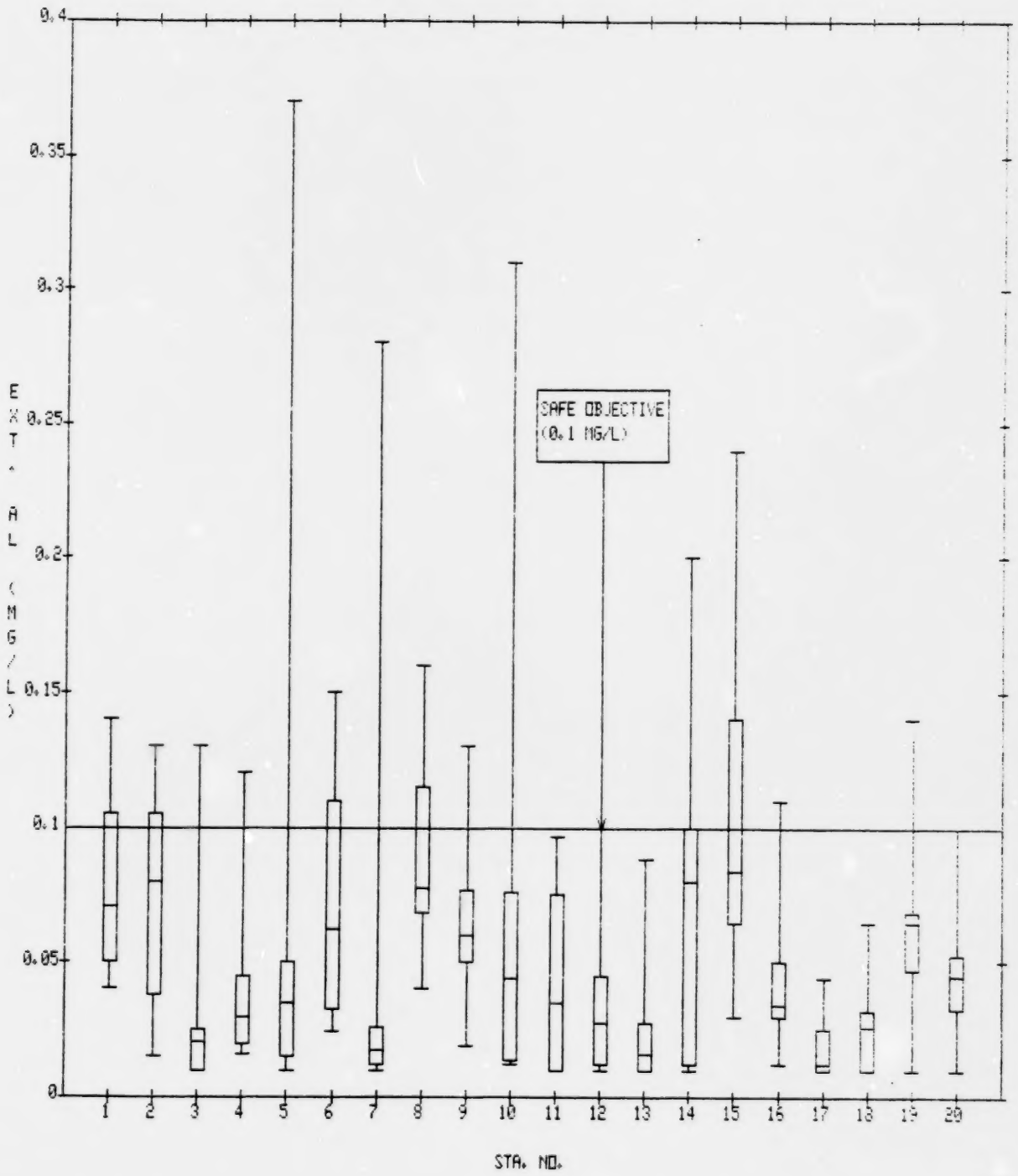


Table 10

Summary Data

Extractable Aluminum (mg/1)

No.	Location	Min.	Max.	Mean	Median	N.	Safe
1.	S.J.R. at Clair	0.040	0.140	0.078	0.071	12	Y
2.	S.J.R. at Edmundston	0.015	0.130	0.074	0.080	13	Y
3.	Little R. at hwy 205	<0.010	0.130	0.038	0.021	10	Y
4.	St. Francis R.	0.016	0.120	0.042	0.030	19	Y
5.	Madawaska R.	<0.010	0.370	0.055	0.035	15	Y
6.	S.J.R. at Caron Brook	0.024	0.150	0.074	0.063	12	Y
7.	Baker Brook at Baker Brook	<0.010	0.280	0.056	0.018	12	Y
8.	S.J.R. at St. Francis, Me.	0.040	0.160	0.091	0.076	12	Y
9.	S.J.R. at St. Leonard	0.019	0.130	0.065	0.060	11	Y
10.	Seigas R. at Seigas	0.012	0.310	0.069	0.044	9	Y
11.	Quisbis R. at T.C.H.	<0.010	0.097	0.043	0.035	9	Y
12.	Iroquois R. at hwy	<0.010	0.100	0.036	0.028	10	Y
13.	Green R. at W.S.C. Gauge	<0.010	0.088	0.023	0.016	17	Y
14.	Grand R. at T.C.H.	<0.010	0.200	0.078	0.080	11	Y
15.	S.J.R. at St. Basile	0.030	0.240	0.108	0.084	15	Y*
16.	Limestone R. at W.S.C. Gauge	0.012	0.110	0.042	0.035	14	Y
17.	Big Presquile Str. at border	<0.010	0.044	0.018	0.012	19	Y
18.	Meduxnekeag R. at Belleville	<0.010	0.065	0.025	0.026	17	Y
19.	S.J.R. at Grand Falls	<0.010	0.140	0.060	0.065	17	Y
20.	Aroostook R. at Tinker Dam	0.020	0.100	0.050	0.048	17	Y

* Mean of 15 samples exceeds objectives.

FIG. 8
DISSOLVED ALUMINUM AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

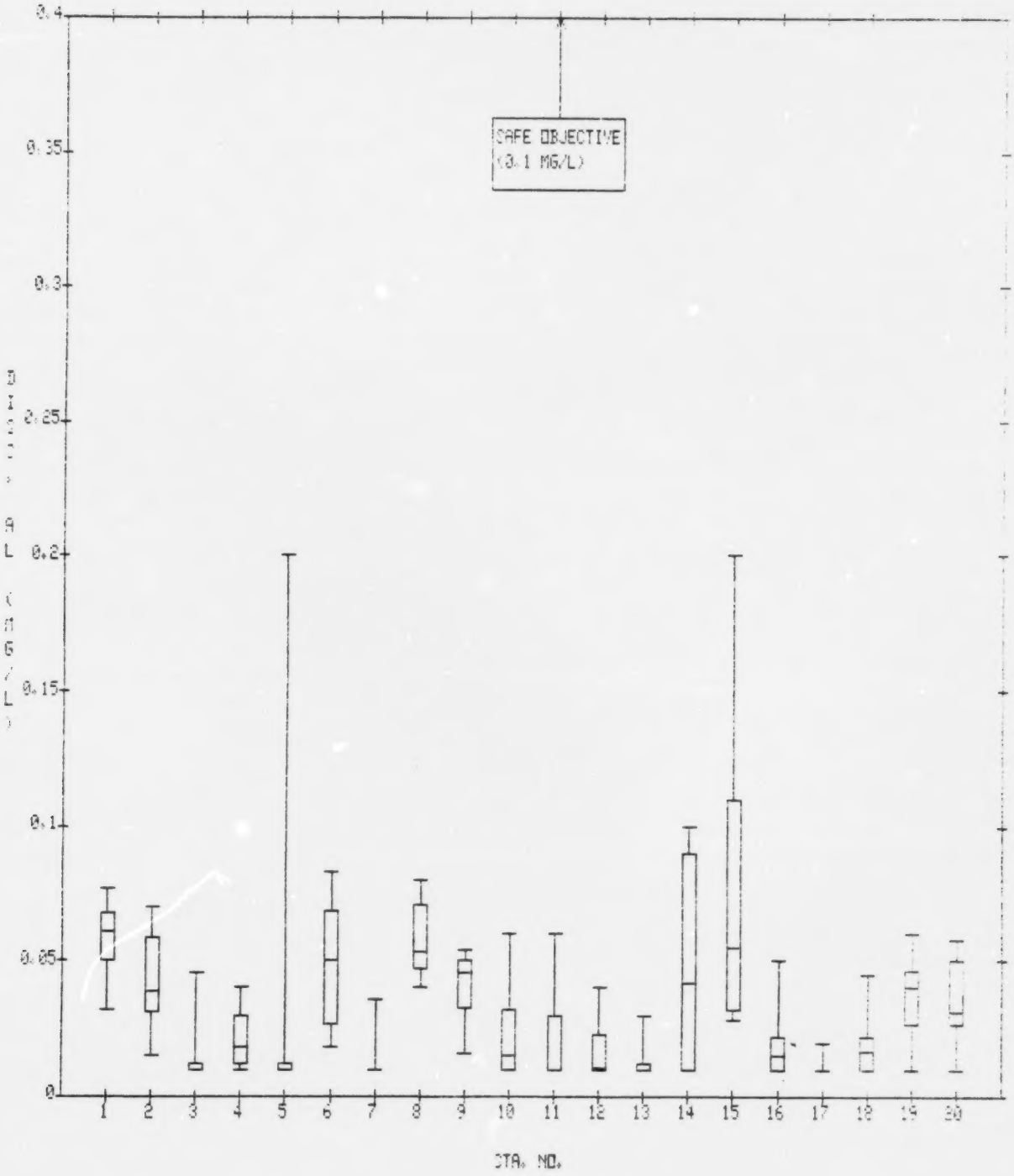


Table 11

Summary Data

Dissolved Aluminum (mg/l)

No.	Location	Min.	Max.	Mean	Median	N.	Acute
1.	S.J.R. at Clair	0.030	0.077	0.056	0.061	12	Y
2.	S.J.R. at Edmundston	0.015	0.070	0.043	0.039	12	Y
3.	Little R. at hwy 205	<0.010	0.046	0.016	0.010	10	Y
4.	St. Francis R.	<0.010	0.040	0.021	0.018	21	Y
5.	Madawaska R.	<0.010	0.200	0.025	<0.010	16	Y
6.	S.J.R. at Caron Brook	0.018	0.083	0.048	0.050	13	Y
7.	Baker Brook at Baker Brook	<0.010	0.036	0.013	<0.010	12	Y
8.	S.J.R. at St. Francis, Me.	0.040	0.080	0.057	0.053	12	Y
9.	S.J.R. at St. Leonard	0.016	0.054	0.040	0.042	11	Y
10.	Seigas R. at Seigas	<0.010	0.060	0.023	0.015	7	Y
11.	Quisbis R. at T.C.H.	<0.010	0.060	0.022	<0.010	7	Y
12.	Iroquois R. at hwy	<0.010	0.040	0.017	0.011	8	Y
13.	Green R. at W.S.C. Gauge	<0.010	0.030	0.012	<0.010	19	Y
14.	Grand R. at T.C.H.	<0.010	0.100	0.042	0.031	12	Y
15.	S.J.R. at St. Basile	0.028	0.200	0.079	0.055	15	Y
16.	Limestone R. at W.S.C. Gauge	<0.010	0.050	0.018	0.015	16	Y
17.	Big Presquile Str. at border	<0.010	0.020	0.011	<0.010	21	Y
18.	Meduxnekeag R. at Belleville	<0.010	0.045	0.018	0.015	19	Y
19.	S.J.R. at Grand Falls	<0.010	0.060	0.036	0.040	18	Y
20.	Aroostook R. at Tinker Dam	<0.010	0.058	0.035	0.030	19	Y

values above 6.0, and many measurements were above 7.0, hence within the range of minimum solubility of naturally occurring aluminum minerals.

None of the individual measurements for dissolved aluminum exceeded, or even approached the "acute" level of 1.0 mg/L. The highest value measured was 0.200 mg/L in two samples - one collected from the Saint John River at St. Basile in February 1985 and one collected from the Madawaska River at Edmundston in October 1984.

Total Phosphorus

Phosphorus is a nutrient which, in excess, can accelerate plant growth, resulting in nuisance conditions which can interfere with some water uses, such as swimming. Indirectly, excess phosphorus levels can also result in lowered dissolved oxygen levels when aquatic plants die and rob oxygen from the water during the decay process.

However, because of the complexity of interrelationships which exist with other nutrients and the available forms of phosphorus itself, a definitive phosphate level cannot be set.

Nevertheless, to prevent nuisance conditions from developing it is widely recommended that phosphorus not exceed 0.1 mg/L in flowing streams, 0.05 mg/L in streams entering an impoundment, and

0.025 mg/L in an impoundment. Furthermore, experience in the State of Maine indicates that a level higher than 0.015 mg/L is indicative of a potential problem, and if phosphorus concentrations on a seasonal basis exceed this level, a survey to determine the trophic status of the water should be undertaken.

Figure 9 is a box and whisker plot of total phosphorus measured at the twenty water quality sampling stations during the two-year sampling period. Table 12 contains the summary statistics for this parameter.

Of the twenty sites sampled, eight had mean total phosphorus levels above the recommended objective of 0.015 mg/L, and four had median levels above that limit.

Individual measurements made at four of the sampling sites were found to have very high levels of phosphorus. Phosphorus enters many of these streams from agricultural land run-off, and the phosphorus content of the run-off may depend more upon the time of year when the run-off occurs, rather than upon the instantaneous river discharge when the samples are collected. Hence, samples collected on a rising or falling limb of the hydrograph in June, soon after spring planting, may contain much higher levels of phosphorus than samples collected on a rising or falling limb of the hydrograph in late summer when plants have taken up the phosphorus, or in winter, when the land surface is frozen.

FIG. 9
TOTAL PHOSPHORUS AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

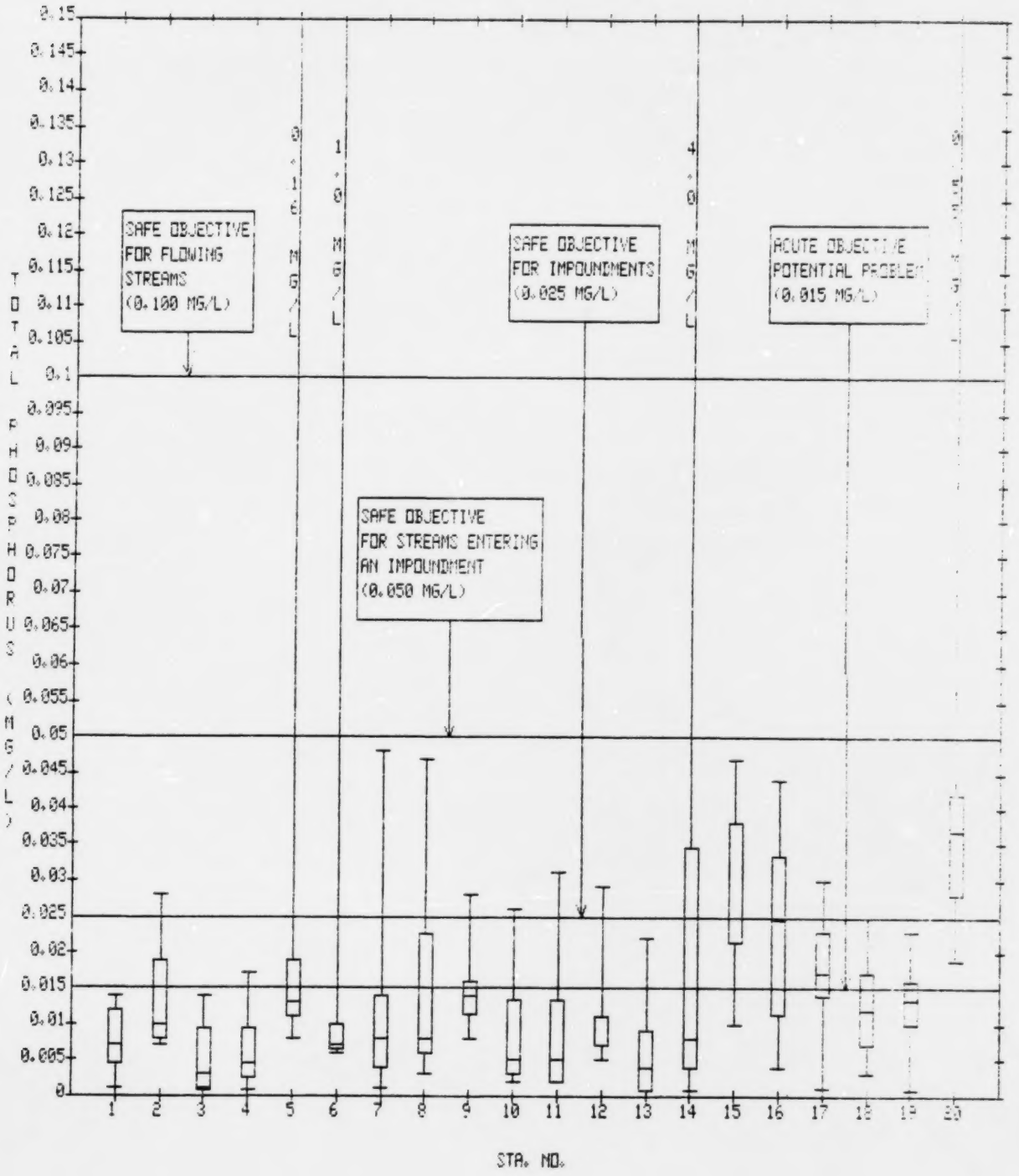


Table 12

Summary Data

Total Phosphorus (mg/l)

No.	Location	Min.	Max.	Mean	Median	N.	Water Type	Nuisance 1 F	Nuisance 2 E	Nuisance 3 I	Potential Bloom
1.	S.J.R. at Clair	0.001	0.014	0.008	0.007	12	F	Y			Y
2.	S.J.R. at Edmundston	0.007	0.028	0.014	0.010	11	F	Y			N
3.	Little River at Hwy 205	< 0.001	0.014	0.005	0.003	9	F	Y			Y
4.	St. Francis R.	< 0.001	0.017	0.006	0.005	20	F	Y			Y
5.	Madawaska R.	0.008	0.16	0.024	0.013	15	I			Y	N
6.	S.J.R. at Caron Brook	0.006	1.0	0.084	0.007	13	F	Y			N
7.	Baker Brook	0.001	0.048	0.013	0.008	11	F	Y			N
8.	S.J.R. at St. Francis,Me.	0.003	0.047	0.016	0.008	12	F	Y			N
9.	S.J.R. at St. Leonard	0.008	0.028	0.015	0.014	12	E		Y		Y
10.	Seigas R.	0.002	0.026	0.009	0.005	9	F	Y			Y
11.	Quisbis R.	0.002	0.031	0.009	0.005	9	F	Y			Y
12.	Iroquois R.	0.005	0.029	0.010	0.007	10	F	Y			Y
13.	Green R.	< 0.001	0.022	0.006	0.004	19	F	Y			Y
14.	Grand R.	< 0.001	4.0	0.32	0.008	13	F	Y			Y
15.	S.J.R. at St. Basile	0.010	0.047	0.028	0.025	13	F	Y			N
16.	Limestone R.	0.004	0.044	0.023	0.025	16	F	Y			N
17.	Big Presque Isle	0.001	0.030	0.018	0.017	21	F	Y			N
18.	Meduxnekeag R.	0.003	0.025	0.012	0.012	19	F	Y			N
19.	S.J.R. at Grand Falls	< 0.001	0.023	0.013	0.014	18	I		Y		N
20.	Aroostook R.	0.019	0.55	0.066	0.037	18	I	Y			N

1. Flowing Water
2. Streams entering an impoundment
3. Impoundment

Phosphorus has a great affinity to be adsorbed onto sediment particles, and the high levels of total phosphorus found in individual samples can be attributed to high run-off events, and thus high suspended solids loading in the river basin when the samples were collected. Much of this total phosphorus may not be available for primary production.

Because the mean value can be significantly affected by a single outlying value, the median values will be used to compare the data to the water quality objectives.

Four of the twenty stations sampled in the basin had median total phosphorus levels above the 0.015 mg/L level recommended as indicative of a potential problem. The sampling station locations where median total phosphorus levels were greater than the 0.015 mg/L limit were:

The Saint John River at St. Basile - Median = 0.025 mg/L
The Limestone River at Four Falls - Median = 0.025 mg/L
The Big Presque Isle Stream at Can/U.S. Border- Median = 0.017 mg/L
The Aroostook River at Tinker Dam - Median = 0.037 mg/L

With the exception of the Saint John River at St. Basile, where the source of phosphorus is probably the Fraser Cos. wastewater treatment plant, where phosphorus is added to the pulp mill waste to promote biological growth in the treatment plant, the three streams which are of interest are the international transboundary tributaries, the Aroostook, Limestone and Big Presque Isle, where both mean and median levels of total phosphorus for the

two-year sampling period exceed the recommended 0.015 mg/L limit. The major source of phosphorus in these transboundary tributaries is probably land run-off from agricultural land, with domestic sewage from the towns of Presque Isle, Caribou and Fort Fairfield contributing some phosphorus to the Aroostook River.

Dissolved Total Phosphorus

Phosphorus has a great affinity to be adsorbed onto sediment particles, and the high levels of total phosphorus found in individual grab samples can generally be attributed to high run-off events in the river basin when the samples were collected. Much of this total phosphorus may be associated with organic matter and clays and hence would not be available for primary production. Concentrations of dissolved total phosphorus are a better indicator of potential eutrophication in a water body, and for this reason samples collected during the 1984-1985 sampling period were filtered in the field and dissolved total phosphorus concentrations were measured in the samples.

Figure 10 is a box and whisker plot of dissolved total phosphorus measured at the twenty water quality sampling stations over the two-year sampling period, and Table 13 contains the summary statistics for this parameter.

Of the twenty sites sampled, four had mean total dissolved phosphorus levels above the recommended objective of 0.015 mg/L,

FIG. 10
TOTAL DISSOLVED PHOSPHORUS AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

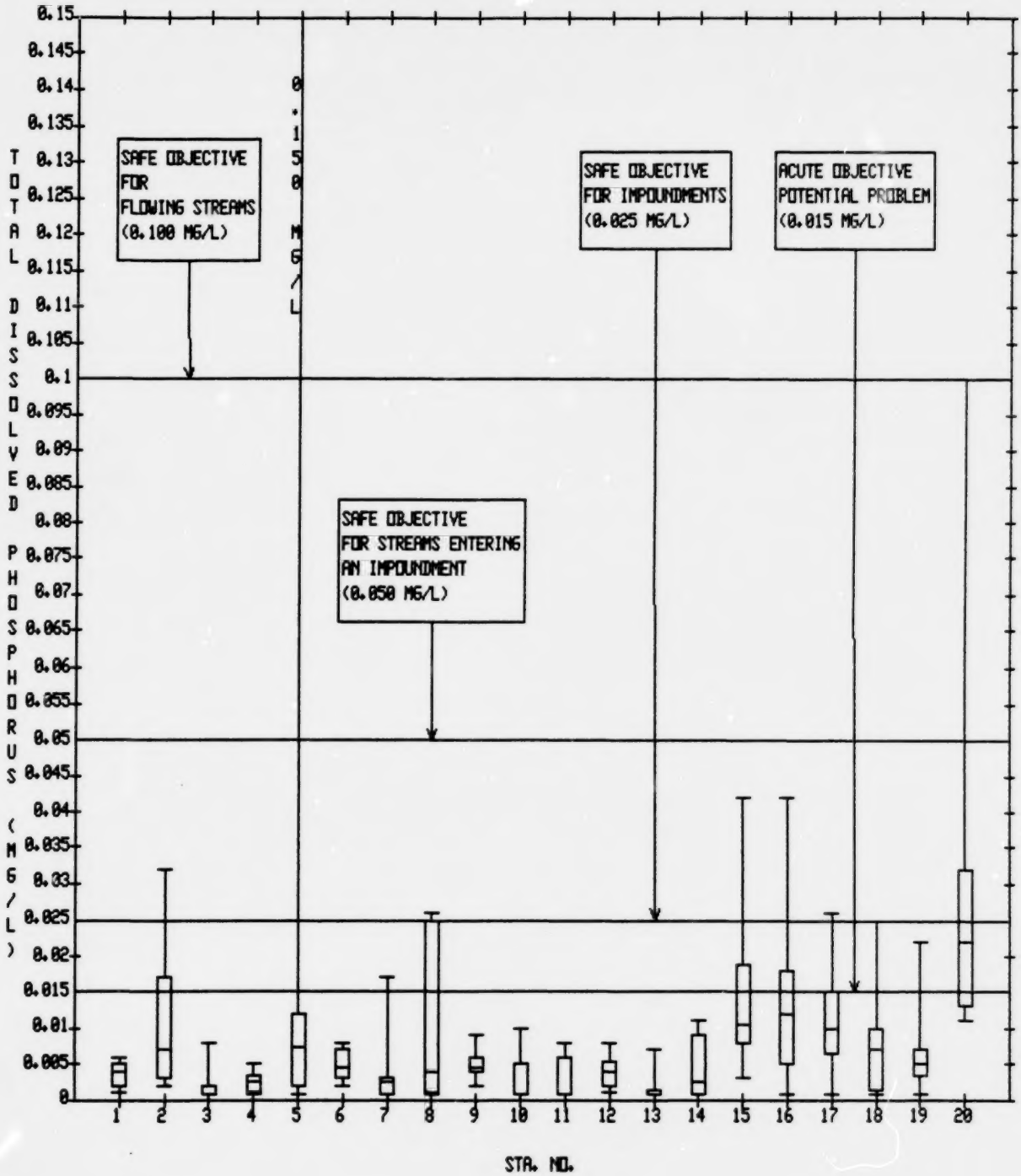


Table 13

Summary Data

Dissolved Total Phosphorus (mg/l)

No.	Location	Min.	Max.	Mean	Median	N	Safe
1.	S.J.R. at Clair	0.001	0.006	0.004	0.004	10	Y
2.	S.J.R. at Edmundston	0.002	0.032	0.011	0.007	9	Y
3.	Little River at Hwy 205	< 0.001	0.008	0.002	< 0.001	9	Y
4.	St. Francis R.	< 0.001	0.005	0.003	0.003	16	Y
5.	Madawaska R.	< 0.001	0.150	0.018	0.008	14	Y
6.	S.J.R. at Caron Brook	0.002	0.008	0.005	0.005	12	Y
7.	Baker Brook at Baker Brook	< 0.001	0.017	0.003	0.003	10	Y
8.	S.J.R. at St. Francis, Me.	< 0.001	0.026	0.010	0.004	10	Y
9.	S.J.R. at St. Leonard	0.002	0.009	0.005	0.005	10	Y
10.	Seigas R. at Seigas	< 0.001	0.010	0.003	< 0.001	9	Y
11.	Quisbis R. at T.C.H.	< 0.001	0.008	0.003	< 0.001	9	Y
12.	Iroquois R. at hwy	0.001	0.008	0.004	0.004	9	Y
13.	Green R. at W.S.C. Gauge	< 0.001	0.007	0.002	< 0.001	17	Y
14.	Grand R. at T.C.H.	< 0.001	0.011	0.004	0.003	10	Y
15.	S.J.R. at St. Basile	0.003	0.042	0.017	0.011	14	Y
16.	Limestone R. at WSC Gauge	< 0.001	0.042	0.015	0.012	15	Y
17.	Big Presque Isle Str. at border	< 0.001	0.026	0.011	0.010	20	Y
18.	Meduxnekeag R. at Belleville	< 0.001	0.025	0.007	0.007	17	Y
19.	S.J.R. at Grand Falls	< 0.001	0.022	0.006	0.005	17	Y
20.	Aroostook R. at Tinker Dam	0.011	0.100	0.029	0.022	17	N

and only one had a median level above that limit. The dissolved portion of total phosphorus concentrations measured in individual samples ranged from <1% to 100%, with no well defined relationship between the dissolved component and the total phosphorus concentration in samples collected from any of the sampling stations. Generally, however, the dissolved phosphorus concentrations measured in samples collected during times of high suspended solids loading were less than 20% of the total phosphorus concentrations, and this is reflected in the significantly lower median concentration of dissolved total phosphorus measured at most of the sampling stations. The only station where the median total dissolved phosphorus concentration exceeded the recommended limit of 0.015 mg/L was in the Tinker Dam Headpond on the Aroostook River.

Suspended Solids

The most important aquatic effect of high levels of suspended solids is the loss of aquatic habitat caused by siltation. The main source of siltation in the International Saint John River Basin is probably due to agricultural practices, with lesser contributions from forestry operations.

Sustained suspended solids in the range of 25-100 mg/L may result in reduced fish production, but in the short term, aquatic life can tolerate several thousand ppm. Good land management practices should aim at reducing suspended solids levels to below

25 mg/L and this figure has been adopted as a "safe" limit to protect the fisheries resource. In addition, ITAS has recommended that, on an individual sample basis, concentrations greater than 100 mg/L should be investigated, since levels greater than this indicate poor land use practices.

Figure 11 is a box and whisker plot of suspended solids concentrations measured at twenty sampling stations during the 1984-1985 sampling period, and Table 14 lists the minimum and maximum levels measured, the arithmetic mean level, the median level, the total number of sample measurements made at each site and compliance with the "safe" water quality objective for the International Saint John Basin.

Suspended solids levels for all of the sites sampled are generally <10.0 mg/L, although samples collected after intense rainfall at some of the stations contained higher concentrations of suspended solids. Because the arithmetic mean concentrations are heavily weighed by these high values during periods of heavy run-off, the use of median values for the sampling period is more appropriate when comparing the data to the water quality objectives. As indicated by table 14, the median level of suspended solids for the two year sampling period at all of the sampling stations is below the "safe" objective.

However, individual samples collected during or soon after a period of intense rainfall at several of the sampling stations were

Fig. 11
NONFILTERABLE RESIDUE AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

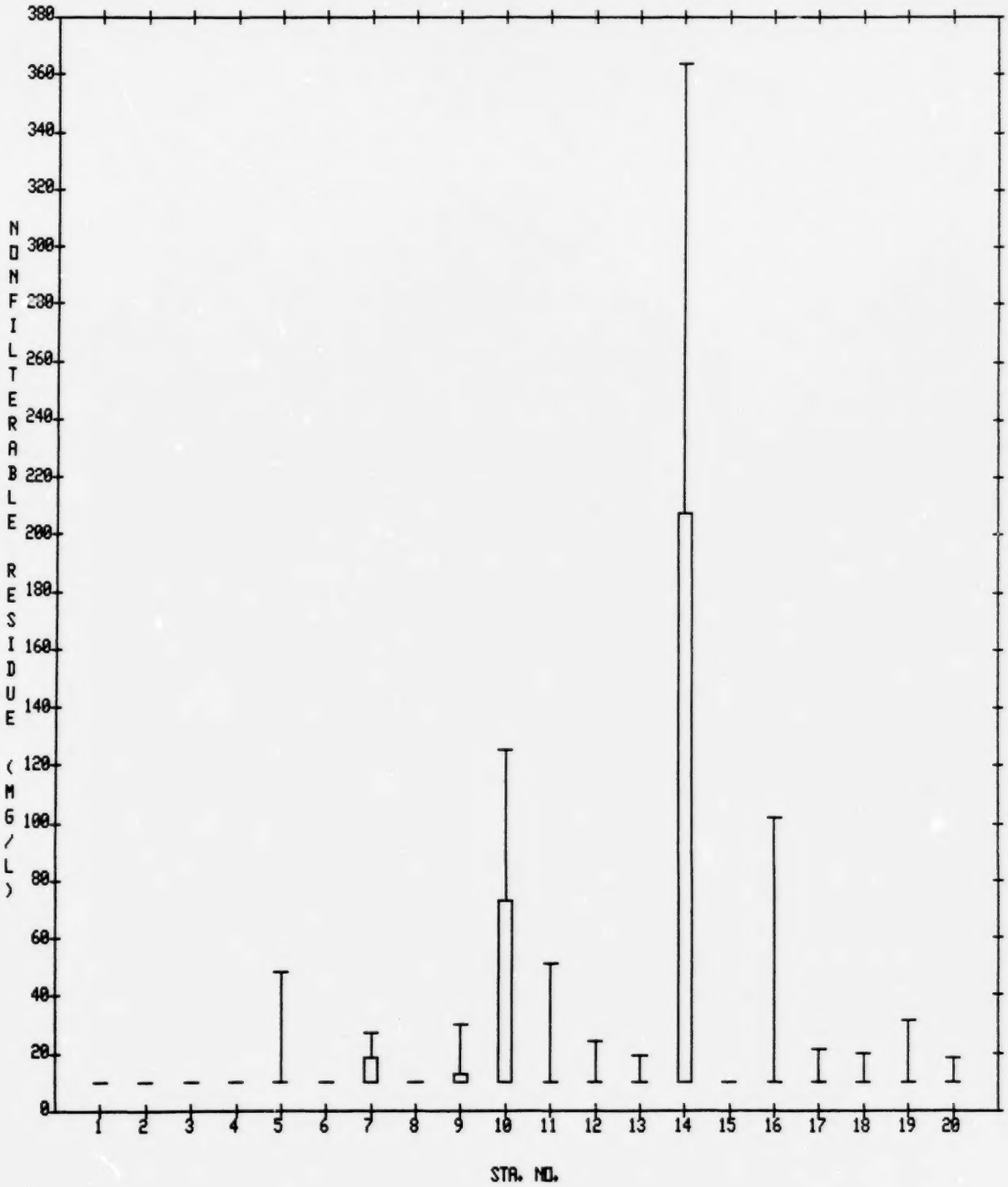


Table 14

Summary Data

Suspended Solids (mg/L)

No.	Location	Min.	Max.	Mean	Median	N.	Safe
1.	S.J.R. at Clair	<10	<10	<10	<10	8	Y
2.	S.J.R. at Edmundston	<10	<10	<10	<10	9	Y
3.	Little R. at hwy.205	<10	<10	<10	<10	7	Y
4.	St. Francis R.	<10	<10	<10	<10	10	Y
5.	Madawaska R.	<10	48.0	13.2	<10	12	Y
6.	S.J.R. at Caron Brook	<10	<10	<10	<10	6	Y
7.	Baker Brook at Baker Brook	<10	27.0	14.2	<10	6	Y
8.	S.J.R. at St. Francis, Me.	<10	<10	<10	<10	6	Y
9.	S.J.R. at St. Leonard	<10	29.8	12.5	<10	11	Y
10.	Seigas R. at Seigas	<10	125.0	35.0	<10	5	Y
11.	Quisbis R. at T.C.H.	<10	51.0	16.8	<10	6	Y
12.	Iroquois R. at hwy.	<10	24.0	12.3	<10	6	Y
13.	Green R. at W.S.C. Gauge	<10	19.2	10.6	<10	14	Y
14.	Grand R. at T.C.H.	<10	364.0	84.6	<10	11	Y
15.	S.J.R. at St. Basile	<10	<10	<10	<10	8	Y
16.	Limestone R. at W.S.C. Gauge	<10	102.2	20.6	<10	10	Y
17.	Big Presquile Str. at border	<10	21.0	11.1	<10	9	Y
18.	Meduxnekeag R. at Belleville	<10	20.0	10.9	<10	10	Y
19.	S.J.R. at Grand Falls	<10	31.0	11.8	<10	11	Y
20.	Aroostook R. at Tinker Dam	<10	18.4	10.7	<10	11	Y

found to have suspended solids concentrations above the 100 mg/L level, indicating the possibility of poor land use practices in parts of the basin.

The highest concentration of suspended solids measured was 364.0 mg/L in the Grand River in samples collected on June 27/84. Samples here were collected after an intense summer storm during which 24.1 mm and 23.9 mm of rain fell on the St. Leonard - Van Buren area on June 25 and June 26, 1984.

The Grand River appears to be particularly susceptible to high levels of suspended sediment for short periods of time following rainfall in the basin, presumably resulting from erosion of agricultural land in the sub-basin.

Zinc

Because of its potential toxicity to fish, the water quality objective for zinc concentrations in the International Saint John River Basin has been established as 0.030 mg/L for the "safe" level and 0.080 for the "acute" level. Figure 14 and Table 17 indicate the summary statistics for the concentrations of extractable zinc measured at the twenty water quality sampling stations during the two-year sampling period.

As shown, all samples were found to have extractable zinc concentrations well below the 0.030 mg/L level of the "safe" objective. Indeed, with the exception of samples collected in August 1984, when contamination of the nitric acid used to preserve the water samples is suspected (section on quality control), all of the samples collected at many of the water quality sampling stations were found to have concentrations of extractable zinc below the detection limit of the analytical method employed to analyze the samples (0.010 mg/L). The highest level measured was 0.020 mg/L in a sample collected on October 30/84 from the Madawaska River.

Copper

Based upon the incipient lethal level of copper to Atlantic salmon, the water quality objectives established for the International Saint John River Basin for fisheries use are 0.005

FIG. 14
EXTRACTABLE ZINC AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

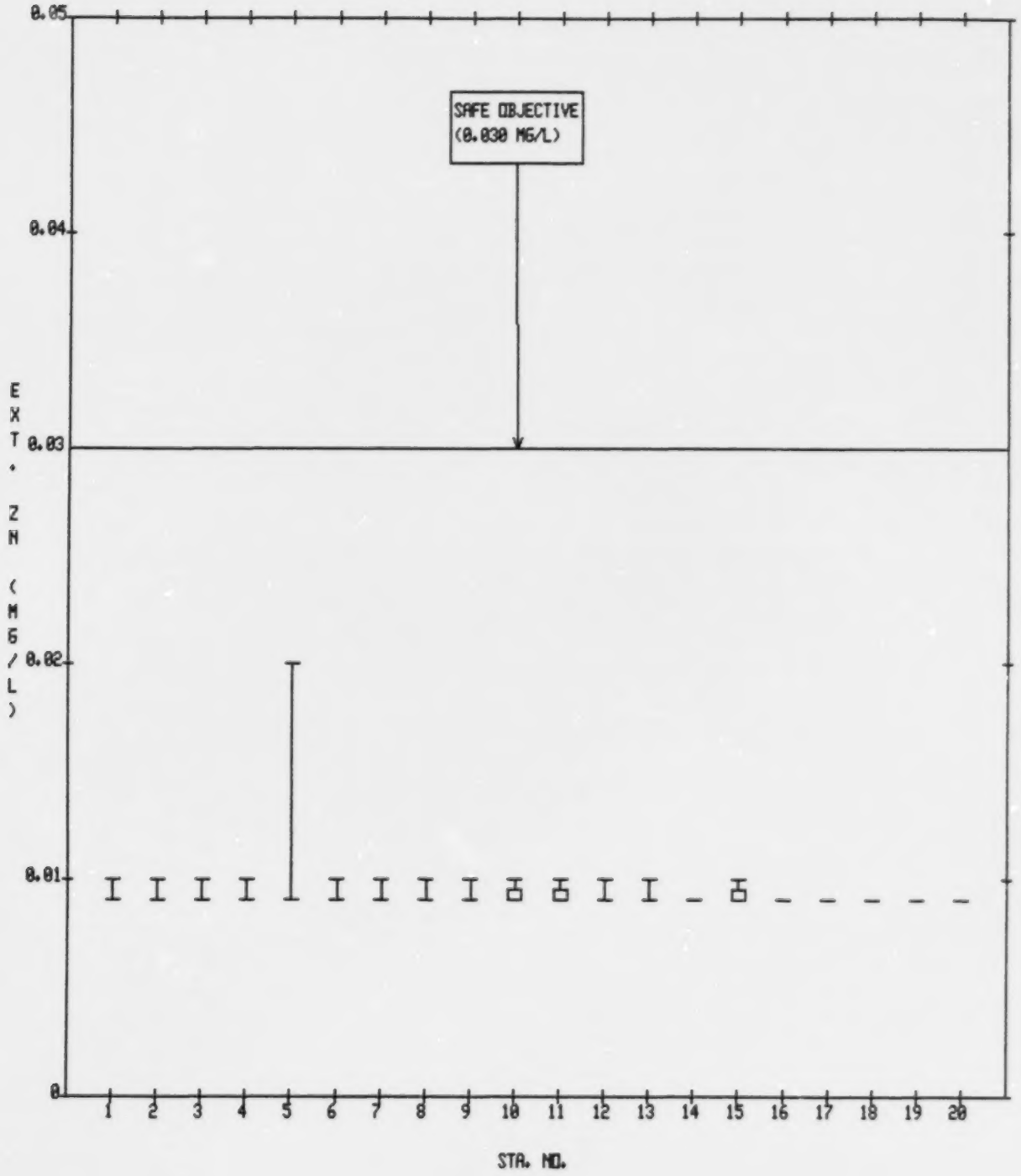


Table 17

Summary Data

Extractable Zinc (mg/l)

No.	Location	Min.	Max.	Mean	Median	N	Safe
1.	S.J.R.at Clair	<0.010	0.010	<0.010	<0.010	9	Y
2.	S.J.R. at Edmundston	<0.010	0.010	<0.010	<0.010	10	Y
3.	Little R. at hwy 205	<0.010	0.010	<0.010	<0.010	6	Y
4.	St. Francis R.	<0.010	0.010	<0.010	<0.010	12	Y
5.	Madawaska R.	<0.010	0.020	<0.010	<0.010	15	Y
6.	S.J.R. at Caron Brook	<0.010	0.010	<0.010	<0.010	10	Y
7.	Baker Brook at Baker Brook	<0.010	0.010	<0.010	<0.010	6	Y
8.	S.J.R. at St. Francis,Me	<0.010	0.010	<0.010	<0.010	7	Y
9.	S.J.R. at St. Leonard	<0.010	0.010	<0.010	<0.010	10	Y
10.	Seigas R. at Seigas	<0.010	0.010	<0.010	<0.010	5	Y
11.	Quisbis R. at T.C.H.	<0.010	0.010	<0.010	<0.010	5	Y
12.	Iroquois R. at hwy	<0.010	0.010	<0.010	<0.010	6	Y
13.	Green R. at W.S.C. Gauge	<0.010	0.010	<0.010	<0.010	13	Y
14.	Grand R.at T.C.H.	<0.010	<0.010	<0.010	<0.010	10	Y
15.	S.J.R. at St. Basile	<0.010	0.010	<0.010	<0.010	9	Y
16.	Limestone R. at W.S.C. Gauge	<0.010	<0.010	<0.010	<0.010	10	Y
17.	Big Presquile Str. at border	<0.010	<0.010	<0.010	<0.010	10	Y
18.	Meduxnekeag R. at Belleville	<0.010	<0.010	<0.010	<0.010	10	Y
19.	S.J.R. at Grand Falls	<0.010	<0.010	<0.010	<0.010	23	Y
20.	Aroostook R. at Tinker Dam	<0.010	<0.010	<0.010	<0.010	10	Y

Fig. 12
EXTRACTABLE CU AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

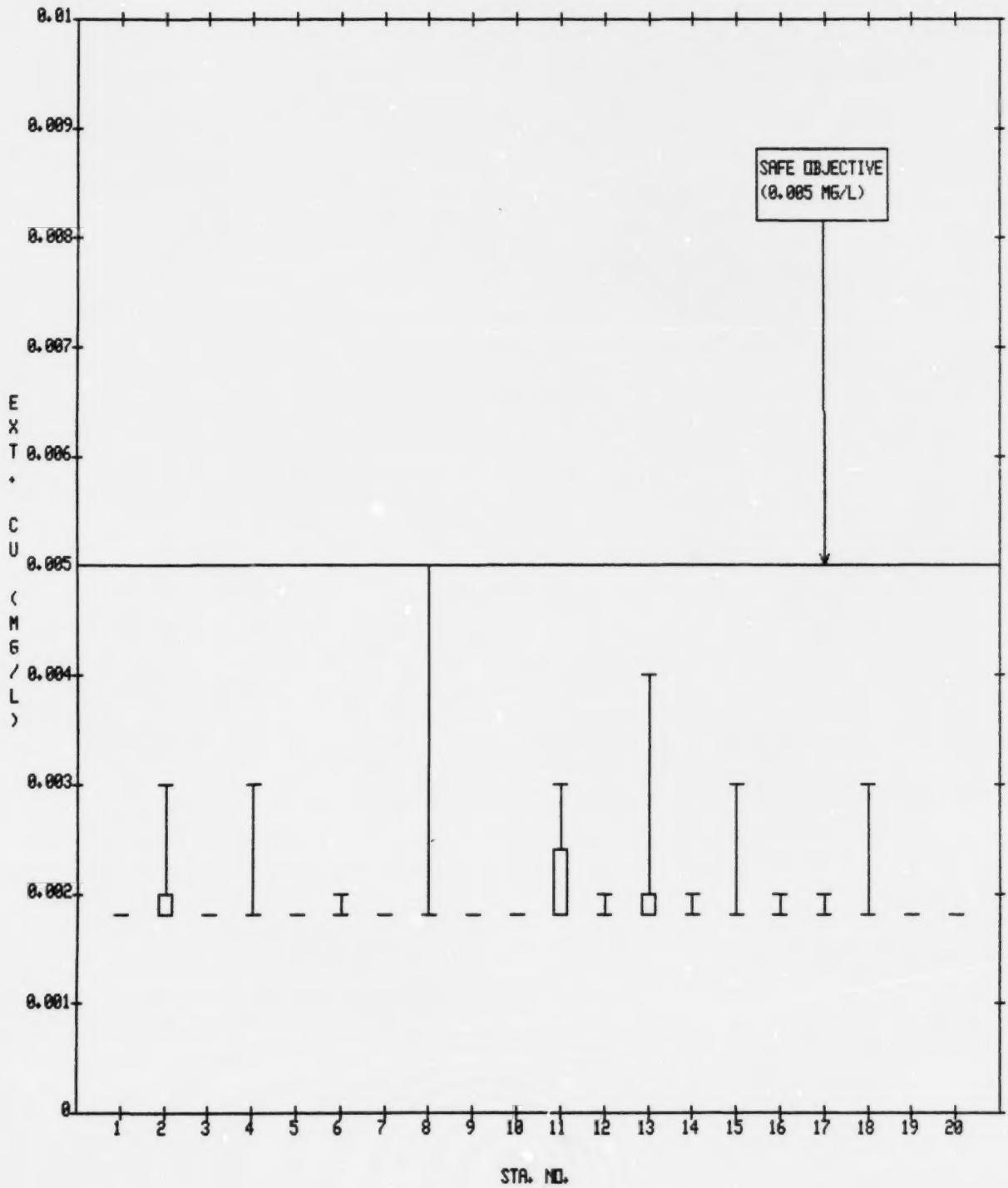


Table 15

Summary Data

Extractable Copper (mg/L)

No.	Location	Min.	Max.	Mean	Median	N.	Safe	Acute
1.	S.J.R. at Clair	<0.002	<0.002	<0.002	<0.002	9	Y	Y
2.	S.J.R. at Edmundston	<0.002	0.003	0.002	<0.002	10	Y	Y
3.	Little R. at hwy. 205	<0.002	<0.002	<0.002	<0.002	6	Y	Y
4.	St. Francis R.	<0.002	0.003	0.002	<0.002	12	Y	Y
5.	Madawaska R.	<0.002	<0.002	<0.002	<0.002	15	Y	Y
6.	S.J.R. at Caron Brook	<0.002	0.002	<0.002	<0.002	10	Y	Y
7.	Baker Brook at Baker Brook	<0.002	<0.002	<0.002	<0.002	6	Y	Y
8.	S.J.R. at St. Francis, Me.	<0.002	0.005	0.002	<0.002	7	Y	Y
9.	S.J.R. at St. Leonard	<0.002	<0.002	<0.002	<0.002	10	Y	Y
10.	Seigas R. at Seigas	<0.002	<0.002	<0.002	<0.002	5	Y	Y
11.	Quisbis R. at T.C.H.	<0.002	0.003	0.002	<0.002	5	Y	Y
12.	Iroquois R. at hwy.	<0.002	0.002	<0.002	<0.002	6	Y	Y
13.	Green R. at W.S.C. Gauge	<0.002	0.004	0.002	<0.002	13	Y	Y
14.	Grand R. at T.C.H.	<0.002	0.002	<0.002	<0.002	10	Y	Y
15.	S.J.R. at St. Basile	<0.002	0.003	0.002	<0.002	9	Y	Y
16.	Limestone R. at W.S.C. Gauge	<0.002	0.002	<0.002	<0.002	10	Y	Y
17.	Big Presquile Str. at border	<0.002	0.002	<0.002	<0.002	10	Y	Y
18.	Meduxnekeag R. at Belleville	<0.002	0.003	0.002	<0.002	10	Y	Y
19.	S.J.R. at Grand Falls	<0.002	<0.002	<0.002	<0.002	23	Y	Y
20.	Aroostook R. at Tinker Dam	<0.002	<0.002	<0.002	<0.022	10	Y	Y

mg/L extractable copper for the "safe" level and 0.020 mg/L for the "acute" level. Based upon the fact that copper imparts an undesirable taste to water in the 1.0 to 5.0 mg/L concentration range, the objective to protect swimmers has been established at 1.0 mg/L extractable copper.

Figure 12 is a box and whisker plot of extractable copper concentrations measured at the twenty water quality sampling stations during the two-year sampling period, and Table 15 contains the summary statistics for this parameter.

The mean concentration of extractable copper at all of the sampling sites was at or below the limit of detection of the analytical method employed to analyze the samples, and the median concentration measured over the two-year sampling period at all of the sites was <0.002 mg/L, well below the 0.005 mg/L "safe" objective.

The higest concentration of extractable copper measured over the two-year sampling period at the twenty sampling stations in the basin was 0.005 mg/L measured in a sample collected from the Saint John River at St. Francis, Maine, above the confluence with the St. Francis River, on March 27, 1985. This too is well below the "acute" objective of 0.020 mg/L, and even further below the water quality objective for the protection of swimmers (1.0 mg/L).

Lead

Based on the possible sublethal chronic effects of lead to fish, and the sensitivity of invertebrates to acute lead poisoning, the "safe" objective for extractable lead in the International Saint John River Basin has been established at the 0.005 mg/L concentration, and the "acute" objective at the 0.030 mg/L concentration level. Because of its toxicity to man and the possibility of ingestion by swimmers, the water quality objective level to protect swimmers has been set at the 0.5 mg/L concentration level.

Figure 13 is a box and whisker plot of extractable lead concentrations measured at the twenty water quality sampling stations over the two-year period, and Table 16 contains the summary statistics for this parameter.

The mean concentration of extractable lead at all of the sampling sites was at or below the limit of detection of the analytical method employed to analyze the samples, and the median concentration measured over the two-year sampling period at all of the sites was <0.002 mg/L, well below the 0.005 mg/L "safe" objective.

The highest concentration of extractable lead measured over the two-year sampling period at the twenty sampling sites in the basin was 0.006 mg/L in a sample collected from the Green River on June 27, 1984.

Fig. 13
EXTRACTABLE PB AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

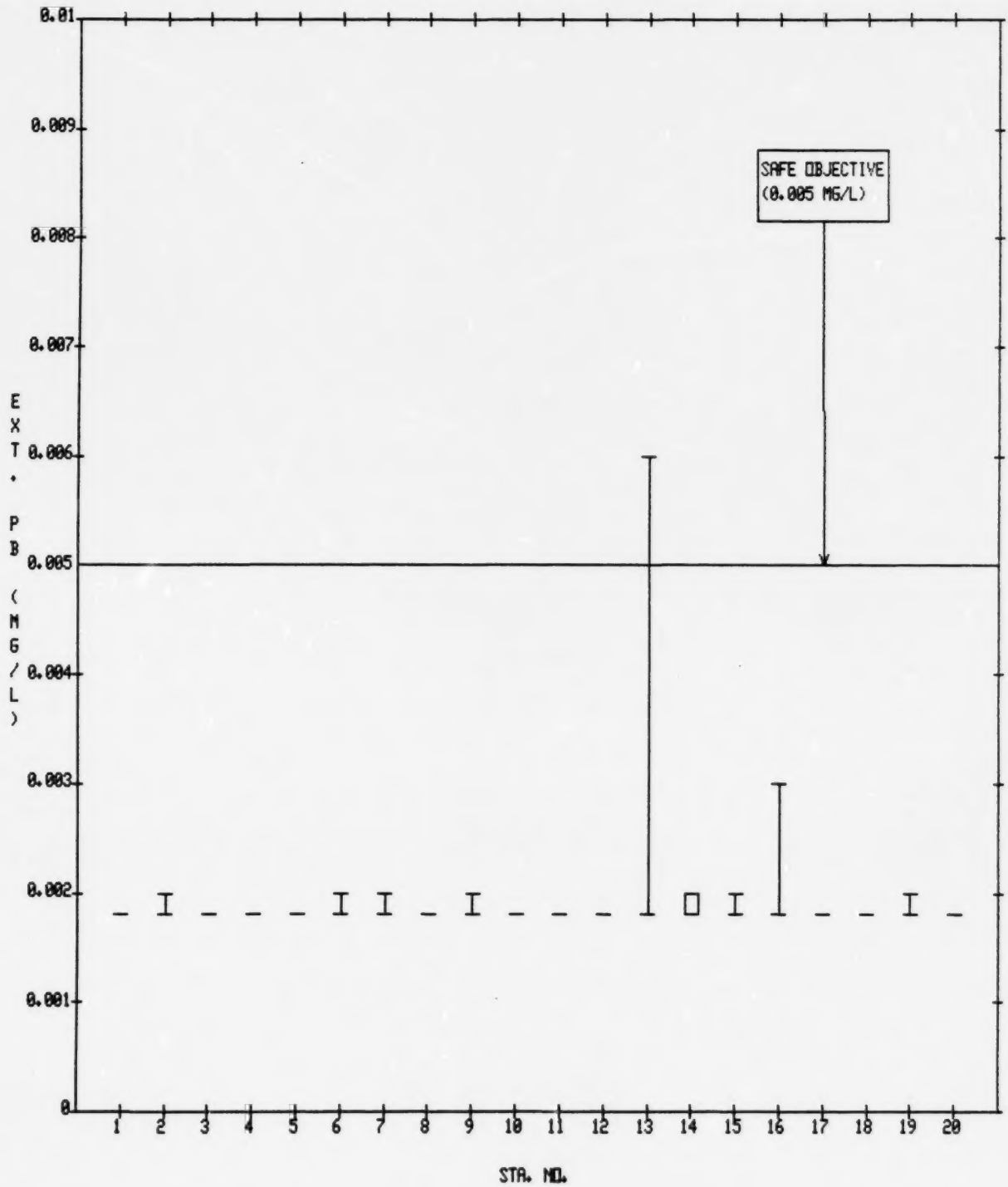


Table 16

Summary Data

Extractable Lead (mg/l)

No.	Location	Min.	Max.	Mean	Median	N	Safe
1.	S.J.R. at Clair	<0.002	<0.002	<0.002	<0.002	9	
2.	S.J.R. at Edmundston	<0.002	0.002	<0.002	<0.002	10	
3.	Little R. at hwy 205	<0.002	<0.002	<0.002	<0.002	6	
4.	St. Francis R.	<0.002	<0.002	<0.002	<0.002	12	
5.	Madawaska R.	<0.002	<0.002	<0.002	<0.002	15	
6.	S.J.R. at Caron Brook	<0.002	0.002	<0.002	<0.002	10	
7.	Baker Brook at Baker Brook	<0.002	0.002	<0.002	<0.002	6	
8.	S.J.R. at St.Francis,Me	<0.002	<0.002	<0.002	<0.002	7	
9.	S.J.R. at St. Leonard	<0.002	0.002	<0.002	<0.002	10	
10.	Seigas R. at Seigas	<0.002	<0.002	<0.002	<0.002	5	
11.	Quisbis R. at T.C.H.	<0.002	<0.002	<0.002	<0.002	5	
12.	Iroquois R. at hwy	<0.002	<0.002	<0.002	<0.002	6	
13.	Green R. at W.S.C. Gauge	<0.002	0.006	0.002	<0.002	13	
14.	Grand R. at T.C.H.	<0.002	0.002	<0.002	<0.002	10	
15.	St.J.R. at St. Basile	<0.002	0.002	<0.002	<0.002	9	
16.	Limestone R. at W.S.C. Gauge	<0.002	0.003	<0.002	<0.002	10	
17.	Big Presquile Str. at border	<0.002	<0.002	<0.002	<0.002	10	
18.	Meduxnekeag R. at Belleville	<0.002	<0.002	<0.002	<0.002	10	
19.	S.J.R. at Grand Falls	<0.002	0.002	<0.002	<0.002	23	
20.	Aroostook R. at Tinker Dam	<0.002	<0.002	<0.002	<0.002	10	

Samples taken on this date were taken after two days of intense rainfall in the basin, with resulting high suspended solids loading. Lead is often sorbed onto soil particles. This level is well below the 0.030 mg/L "acute" water quality objective, and even further below the "swimmers" objective of 0.5 mg/L.

Mercury

To protect aquatic life, the established water quality objectives for the International Saint John River Basin are 0.064 ug/L (as inorganic) for the "safe" level and 3.2 ug/L for the "acute" level. The "swimmers" level is based upon the methylated form of mercury, which is not measured on a routine basis in this monitoring program. Although ITAS has recommended that, when the extractable mercury concentration exceeds the 0.002 mg/L level, an attempt should be made to ascertain the proportion of methylmercury in subsequent monitoring.

Figure 15 is a box and whisker plot of extractable mercury concentrations measured in samples collected from the twenty stations in the International Saint John River Basin over the two-year sampling period, and Table 18 contains the summary statistics for this parameter.

Concentrations of extractable mercury measured in all of the samples collected at the twenty sampling sites in the basin over the two-year period were all below the detection limit (0.020 ug/L) of the analytical method used to analyze the samples, and thus met all of the established objectives for this parameter.

The results of grab sample monitoring over the two-year period in the basin would appear to indicate that trace metals (Cu, Pb, Zn, and Hg) are not a problem, and are well below the levels

established as water quality objectives in the basin.

Fig. 15

EXTRACTABLE HG AT TWENTY SAMPLING SITES
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
1984-1985

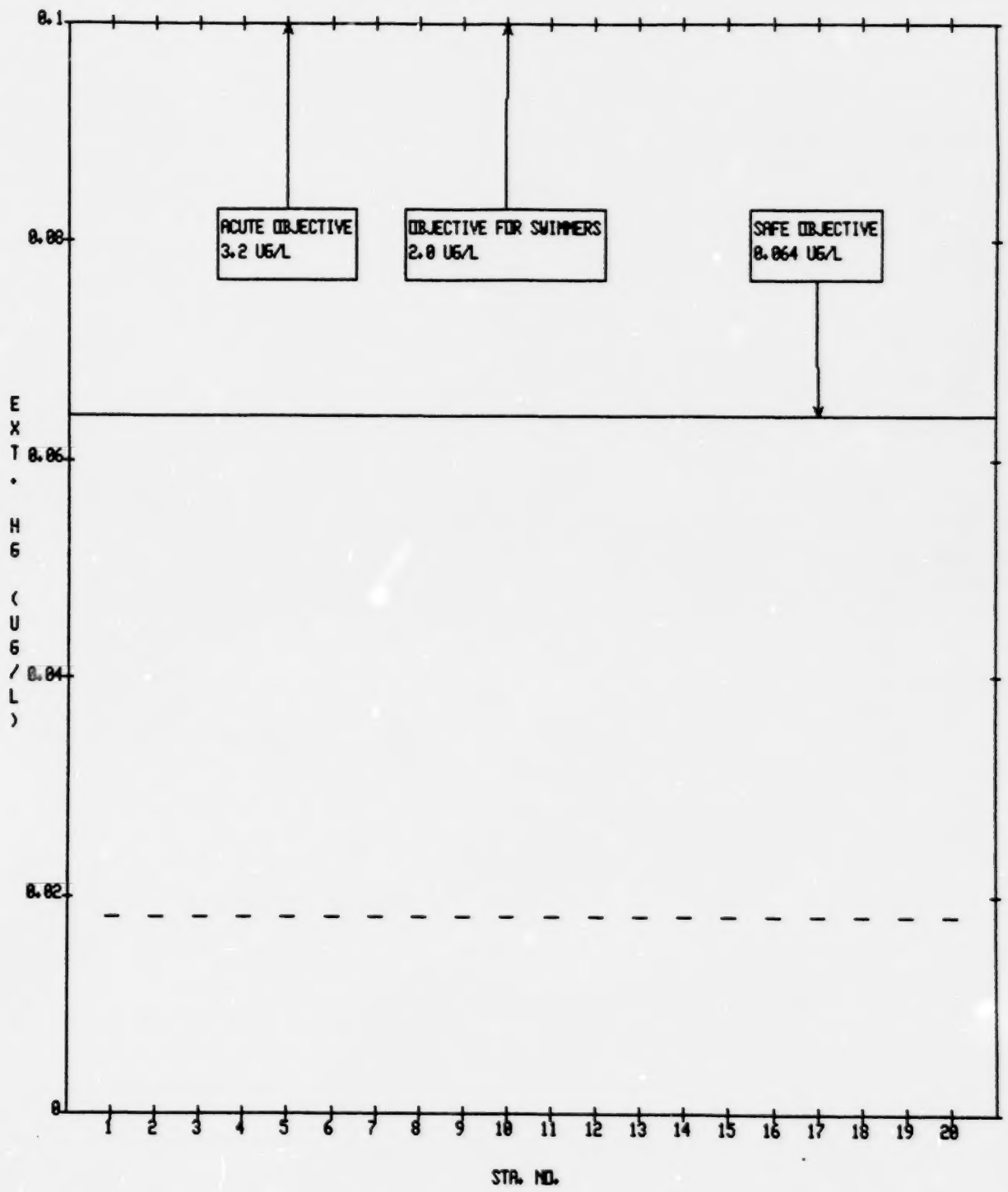


Table 18

Summary Data

Extractable Mercury (ug/L)

No.	Location	Min.	Max.	Mean	Median	N.	Safe	Acute
1.	S.J.R. at Clair	<0.020	<0.020	<0.020	<0.020	9	Y	Y
2.	S.J.R. at Edmundston	<0.020	<0.020	<0.020	<0.020	10	Y	Y
3.	Little R. at hwy. 205	<0.020	<0.020	<0.020	<0.020	6	Y	Y
4.	St. Francis R.	<0.020	<0.020	<0.020	<0.020	10	Y	Y
5.	Madawaska R.	<0.020	<0.020	<0.020	<0.020	13	Y	Y
6.	S.J.R. at Caron Brook	<0.020	<0.020	<0.020	<0.020	8	Y	Y
7.	Baker Brook at Baker Brook	<0.020	<0.020	<0.020	<0.020	6	Y	Y
8.	S.J.R. at St. Francis, Me.	<0.020	<0.020	<0.020	<0.020	7	Y	Y
9.	S.J.R. at St. Leonard	<0.020	<0.020	<0.020	<0.020	10	Y	Y
10.	Seigas R. at Seigas	<0.020	<0.020	<0.020	<0.020	5	Y	Y
11.	Quisbis R. at T.C.H.	<0.020	<0.020	<0.020	<0.020	5	Y	Y
12.	Iroquois R. at hwy.	<0.020	<0.020	<0.020	<0.020	6	Y	Y
13.	Green R. at W.S.C. Gauge	<0.020	<0.020	<0.020	<0.020	13	Y	Y
14.	Grand R. at T.C.H.	<0.020	<0.020	<0.020	<0.020	10	Y	Y
15.	S.J.R. at St. Basile	<0.020	<0.020	<0.020	<0.020	9	Y	Y
16.	Limestone R. at Gauge	<0.020	<0.020	<0.020	<0.020	10	Y	Y
17.	Big Presque Isle Str. at border	<0.020	<0.020	<0.020	<0.020	10	Y	Y
18.	Meduxnekeag R. at Belleville	<0.020	<0.020	<0.020	<0.020	10	Y	Y
19.	S.J.R. at Grand Falls	<0.020	<0.020	<0.020	<0.020	23	Y	Y
20.	Aroostook R. at Tinker Dam	<0.020	<0.020	<0.020	<0.020	10	Y	Y

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Howell, G., 1984. Compliance of Selected Water Quality Parameters to the Objectives of the International Waters of the Saint John River Basin During the Years 1982 and 1983. Water Quality Branch, Atlantic Region, Inland Waters Directorate (IWD-AR-WQB-84-56), March, 1984. 30 p.

TABLE 19. Dissolved oxygen, pH, aluminum and phosphorus concentrations measured in water samples collected in International Saint John River Basin in 1984 - 1985.

SAMPLING STA. NO.	SDATE	STIME	WATER TEMP. (C)	D.O. (mg/l)	D.O. % SAT	pH FIELD (Units)	pH LAB (Units)	Al EXT. (mg/l)	Al DISS. (mg/l)	PHOS. DISS. (mg/l)	PHOS TOTAL (mg/l)
00NB01AD0001	17-MAY-84	1045	6.5	13.8	116.1	7.0	6.7	0.110	0.077	0.001	0.005
00NB01AD0001	04-JUL-84	1245	22.0	8.6	104.2		7.1	0.040	0.040	0.003	0.007
00NB01AD0001	15-AUG-84	1145	21.1	8.2	97.5	7.3	7.2	0.110	0.054	0.006	0.011
00NB01AD0001	30-OCT-84	1650	7.0	9.6	81.9	7.2	7.4	0.050	0.032	0.004	0.014
00NB01AD0001	05-DEC-84	1100	0.0	14.3	101.0	6.9	7.1	0.100	0.073	0.002	0.007
00NB01AD0001	27-MAR-85	1345	0.2	13.2	93.7		7.0	0.072	0.064	0.005	0.014
00NB01AD0001	27-MAR-85	1350	0.2	13.2	93.7		6.9	0.063	0.061		0.003
00NB01AD0001	27-MAR-85	1355	0.2	13.2	93.7		6.9	0.070	0.061		0.006
00NB01AD0001	14-MAY-85	1205	6.7	11.7	99.0	7.5	7.2	0.140	0.066	0.005	0.013
00NB01AD0001	18-JUN-85	1100	17.0	10.0	108.6	7.5	7.3	0.050	0.050	0.004	0.004
00NB01AD0001	15-AUG-85	1150	21.5	8.3	99.5	7.4	7.5	0.040	0.030	0.004	0.010
00NB01AD0001	20-NOV-85	1100	0.5	13.3	95.2		7.3	0.085	0.068	0.001	0.001
00NB01AD0008	17-MAY-84	1201	6.6	13.2	111.4	7.1	6.7	0.120	0.065	0.003	0.009
00NB01AD0008	27-JUN-84	1600	15.5	10.0	105.0	7.5	7.4	0.040	0.040	0.007	0.010
00NB01AD0008	15-AUG-84	1415	23.5	8.3	103.8	7.7	7.5	0.077	0.030	0.008	0.008
00NB01AD0008	30-OCT-84	1230	8.0	15.0	131.2	8.8	7.6	0.045	0.032	0.003	0.007
00NB01AD0008	05-DEC-84	1520	0.0				7.2	0.093	0.070	0.006	0.011
00NB01AD0008	05-DEC-84	1525	0.0					0.090	0.060		
00NB01AD0008	05-DEC-84	1530	0.0					0.100			0.008
00NB01AD0008	29-JAN-85	1450	0.0	11.0	77.7	7.2	7.2	0.036	0.033	0.022	0.028
00NB01AD0008	27-FEB-85	1630	0.5	12.2	87.4		7.1	0.080	0.045	0.032	
00NB01AD0008	26-MAR-85	1410	0.0	13.1	92.5		7.1	0.015	0.015		0.014
00NB01AD0008	14-MAY-85	1000	6.7	11.8	99.8	7.4	7.2	0.130	0.057		0.019
00NB01AD0008	18-JUN-85	1010	17.0	9.8	106.5	7.5	7.4	0.030	0.030	0.002	0.008
00NB01AD0008	20-NOV-85	1015	1.2	12.9	94.2		7.0	0.110	0.038	0.012	0.028
00NB01AD0009	16-MAY-84	1300	5.8	13.8	114.0		6.7	0.110	0.029	0.001	0.012
00NB01AD0009	28-JUN-84	1110	10.3	10.4	96.4	7.2	7.1	0.010	0.010	0.002	0.007
00NB01AD0009	16-AUG-84	1201					7.7	0.130	0.046	0.008	0.014
00NB01AD0009	30-OCT-84	1515	5.5	12.8	104.9	7.0	7.8	0.015	0.010	0.001	0.004
00NB01AD0009	05-DEC-84	945	0.3	15.4	109.7	6.8	7.3	0.025	0.012	0.001	0.002
00NB01AD0009	05-DEC-84	950	0.3	15.4	109.7	6.8	7.3	0.021	0.012	0.001	0.001
00NB01AD0009	05-DEC-84	955	0.3	15.4	109.7	6.8	7.3	0.025	0.010		0.001
00NB01AD0009	30-JAN-85	1015	0.2	13.5	95.9	7.2	7.4	0.010	0.010	0.001	0.003
00NB01AD0009	27-FEB-85	1115	0.2	14.3	101.5		7.3	0.010	0.010	0.002	
00NB01AD0009	27-MAR-85	1030	0.2	15.1	107.2		7.4	0.020	0.010	0.001	0.001
00NB01AD0013	02-FEB-84	1115	0.5	14.1	101.0		7.4		0.015	0.004	0.006
00NB01AD0013	04-APR-84	1000	1.5	12.9	95.0		6.9		0.020	0.002	0.003
00NB01AD0013	16-MAY-84	1210					6.7	0.095	0.040	0.002	0.009
00NB01AD0013	16-MAY-84	1205					7.6	0.120	0.035	0.003	0.010
00NB01AD0013	16-MAY-84	1201	5.0	14.2	114.9	7.0	7.5	0.110	0.037	0.003	0.014
00NB01AD0013	28-JUN-84	1000	14.4	9.9	101.3	7.4	7.2	0.030	0.030		0.004
00NB01AD0013	15-AUG-84	930	20.5	8.0	93.9	7.5	7.5	0.040	0.030	0.005	0.010
00NB01AD0013	30-OCT-84	1415	10.0	10.7	98.5	7.1	7.3	0.030	0.012	0.001	0.006
00NB01AD0013	05-DEC-84	900	3.6	13.2	102.9	7.1	7.4	0.029	0.019	0.001	0.002
00NB01AD0013	30-JAN-85	930	0.3	13.6	96.8	7.5	7.7	0.017	0.013		0.004
00NB01AD0013	27-FEB-85	1030	0.5	14.8	106.0		7.5	0.018	0.013	0.004	
00NB01AD0013	27-MAR-85	940	1.0	14.3	103.8		7.5	0.020	0.018	0.001	0.001

TABLE 19. Dissolved oxygen, pH, aluminum and phosphorus concentrations measured in water samples collected in International Saint John River Basin in 1984-1985.

SAMPLING STA. NO.	SDATE	STIME	WATER TEMP. (C)	D.O. (mg/l)	D.O. % SAT	pH FIELD (Units)	pH LAB (Units)	Al EXT. (mg/l)	Al DISS. (mg/l)	PHOS. DISS. (mg/l)	PHOS. TOTAL (mg/l)
00NB01AD0013	27-MAR-85	945	1.0	14.3	103.8		7.5	0.025	0.013		0.001
00NB01AD0013	27-MAR-85	950	1.0	14.3	103.8		7.5	0.028	0.018		0.001
00NB01AD0013	14-MAY-85	1130	5.0	12.2	98.7	7.4	7.4	0.072	0.035		0.010
00NB01AD0013	18-JUN-85	1225	15.0	10.2	105.9	7.4	7.4	0.030	0.030	0.002	0.005
00NB01AD0013	15-AUG-85	1030	21.0	7.8	92.5	7.5	7.6	0.030	0.020	0.001	0.004
00NB01AD0013	20-NOV-85	1201	5.5	15.6	127.9		7.7	0.016	0.012	0.001	0.001
00NB01AD0013	18-DEC-85	1201	1.5	12.6	92.7	7.6	7.5	0.017	0.010	0.004	0.017
00NB01AD0013	18-DEC-85	1205					7.4	0.021	0.010	0.003	0.004
00NB01AD0013	18-DEC-85	1210					7.4	0.045	0.010	0.003	0.007
00NB01AD0016	01-FEB-84	1515	0.5	14.5	103.8					0.008	
00NB01AD0016	04-APR-84	1230	4.0	15.0	118.2		7.2		0.015	0.010	0.019
00NB01AD0016	17-MAY-84	1220					7.2	0.040	0.010	0.001	0.008
00NB01AD0016	17-MAY-84	1230					7.2	0.040	0.010	0.001	0.009
00NB01AD0016	17-MAY-84	1210	4.4	14.6	116.3		7.1	0.040	0.010	0.001	0.009
00NB01AD0016	27-JUN-84	1530	11.3	10.9	103.6	6.9	7.0	0.050	0.050	0.017	0.022
00NB01AD0016	15-AUG-84	1345	22.4	8.4	102.6	7.7	7.6	0.030	0.010	0.006	0.014
00NB01AD0016	30-OCT-84	1210	10.5	11.4	106.2	7.4	6.9	0.370	0.200	0.150	0.160
00NB01AD0016	04-DEC-84	1400	1.4	14.3	105.0	6.7	7.4	0.061	0.012	0.021	0.029
00NB01AD0016	29-JAN-85	1520				7.7	7.7	0.015	0.010	0.007	0.011
00NB01AD0016	26-FEB-85	1530	0.5	14.1	101.0		7.5	0.010	0.010	0.012	0.014
00NB01AD0016	26-MAR-85	1345	0.0				7.3	0.010	0.010		0.012
00NB01AD0016	14-MAY-85	930				7.5	7.4	0.072	0.010		0.013
00NB01AD0016	18-JUN-85	1000	14.0	9.6	97.3	7.7	7.7	0.010	0.010	0.002	0.011
00NB01AD0016	14-AUG-85	1345	19.2	7.8	89.0	7.7	7.6	0.035	0.010	0.005	0.017
00NB01AD0016	20-NOV-85	1000	1.0				7.6	0.025	0.010		
00NB01AD0016	18-DEC-85	1025	0.0	12.1	85.4	7.6	7.6	0.021	0.010	0.008	0.011
00NB01AD0017	02-FEB-84	930	0.0				7.0		0.037	0.003	0.006
00NB01AD0017	16-MAY-84	1415	7.0	13.6	116.0	7.0	6.7	0.130	0.070	0.008	1.000
00NB01AD0017	16-MAY-84	1420					6.7	0.150	0.077	0.003	0.007
00NB01AD0017	16-MAY-84	1425					6.7	0.120	0.067	0.002	0.008
00NB01AD0017	04-JUL-84	1350	22.5	8.8	107.7		7.1	0.050	0.050		0.007
00NB01AD0017	16-AUG-84	1330	21.2	8.4	100.1	7.3	7.3	0.100	0.058	0.007	0.014
00NB01AD0017	30-OCT-84	1700	7.5	11.2	96.7	7.3	7.5	0.041	0.032	0.002	0.006
00NB01AD0017	05-DEC-84	1330	0.2	13.9	98.7	7.1	7.1	0.097	0.083	0.005	0.007
00NB01AD0017	30-JAN-85	1400	0.2	12.5	88.8	7.3	7.3	0.036	0.038	0.003	0.007
00NB01AD0017	27-FEB-85	1445	0.2	13.1	93.0		7.3	0.024	0.019	0.007	0.006
00NB01AD0017	27-FEB-85	1450	0.2	13.1	93.0		7.0	0.029	0.022	0.007	0.008
00NB01AD0017	27-FEB-85	1455	0.2	13.1	93.0		7.0	0.030	0.018	0.007	0.007
00NB01AD0017	27-MAR-85	1430	0.2	13.1	93.0		7.1	0.075	0.050	0.004	0.012
00NB01AD0019	16-MAY-84	1500	6.5	13.0	109.4		6.9	0.230	0.016	0.003	0.036
00NB01AD0019	04-JUL-84	1415	20.0	8.6	99.8		7.4	0.010	0.010	0.003	0.014
00NB01AD0019	16-AUG-84	1415	18.8	9.2	104.0	8.3	7.5	0.280	0.036	0.017	0.048
00NB01AD0019	30-OCT-84	1735					7.7	0.015	0.010	0.001	0.008
00NB01AD0019	30-OCT-84	1740					7.7	0.017	0.010		
00NB01AD0019	30-OCT-84	1731	5.0	12.0	97.1	7.2	7.9	0.020	0.010	0.002	0.008
00NB01AD0019	05-DEC-84	1430	0.3	14.0	99.7	7.2	7.4	0.032	0.010		0.004
00NB01AD0019	05-DEC-84	1431	0.3	14.0	99.7	7.2	7.5	0.016	0.010	0.001	0.013
00NB01AD0019	05-DEC-84	1432	0.3	14.0	99.7	7.2	7.7	0.019	0.010	0.001	0.005

TABLE 19 . Dissolved oxygen, pH, aluminum and phosphorus concentrations measured in water samples collected in International Saint Basin in 1984 - 1985.

SAMPLING STA. NO.	SDATE	STIME	WATER TEMP. (C)	D.O. (mg/l)	D.O. % SAT	pH FIELD (Units)	pH LAB (Units)	Al EXT. (mg/l)	Al DISS. (mg/l)	PHOS. DISS (mg/l)	PHOS. TOTAL (mg/l)
00NB01AD0019	05-DEC-84	1432	0.3	14.0	99.7	7.2	7.7	0.019	0.010	0.001	0.005
00NB01AD0019	30-JAN-85	1430	0.3	12.5	89.0	7.3	7.6	0.010	0.010	0.003	0.005
00NB01AD0019	27-FEB-85	1530	0.2	13.9	98.7		7.4	0.010	0.010	0.003	0.004
00NB01AD0019	27-MAR-85	1450	0.0	15.2	107.3		7.1	0.018	0.010	0.001	0.001
00NB01AD0031	17-MAY-84	930	7.0	12.6	107.4	7.0	6.7	0.100	0.077	0.001	0.005
00NB01AD0031	28-JUN-84	1300	15.5	10.2	107.1	7.1	7.1	0.080	0.080	0.005	0.008
00NB01AD0031	16-AUG-84	1235	22.0	8.8	106.6	7.6	7.0	0.065	0.050	0.005	0.008
00NB01AD0031	30-OCT-84	1600	8.5	13.7	121.4	8.1	7.6	0.050	0.040	0.001	0.010
00NB01AD0031	05-DEC-84	1145	0.5	13.9	99.5	7.3	7.1	0.100	0.078	0.003	0.008
00NB01AD0031	30-JAN-85	1120	0.1	13.0	92.1	7.3	7.3	0.040	0.045	0.001	0.008
00NB01AD0031	27-FEB-85	1335	0.2	13.7	97.3		6.5	0.160	0.055	0.026	0.046
00NB01AD0031	27-FEB-85	1340	0.2	13.7	97.3		7.0	0.150	0.042	0.025	0.047
00NB01AD0031	27-FEB-85	1330	0.2	13.7	97.3		6.9	0.130	0.051	0.026	0.035
00NB01AD0031	27-MAR-85	1145	0.5	14.4	103.1		7.1	0.072	0.050	0.003	0.007
00NB01AD0031	27-MAR-85	1150	0.5	14.4	103.1		7.1	0.075	0.057		0.003
00NB01AD0031	27-MAR-85	1155	0.5	14.4	103.1		7.1	0.075	0.064		0.003
00NB01AF0002	01-FEB-84	915	0.0				7.2		0.022	0.005	0.009
00NB01AF0002	15-MAY-84	1430	6.3	13.6	113.9	7.2	6.8	0.130	0.050	0.003	0.017
00NB01AF0002	26-JUN-84	1615	15.0	9.2	95.5	7.4	7.3	0.050	0.050	0.006	0.015
00NB01AF0002	26-JUN-84	1620	15.0	9.2	95.5	7.4	7.0	0.050	0.050	0.009	0.012
00NB01AF0002	26-JUN-84	1625	15.0	9.2	95.5	7.4	7.2	0.050	0.050	0.006	0.014
00NB01AF0002	14-AUG-84	1330	22.0	8.2	99.3	7.5	7.4	0.051	0.033	0.005	0.011
00NB01AF0002	30-OCT-84	820	7.0	10.4	88.7	6.7	7.8	0.092	0.042	0.004	0.028
00NB01AF0002	04-DEC-84	845	0.5	13.3	95.2	6.6	7.2	0.077	0.054	0.002	0.008
00NB01AF0002	29-JAN-85	840	0.1	12.3	87.1	7.4	7.3	0.060	0.040	0.004	0.013
00NB01AF0002	26-FEB-85	900	0.5	12.1	86.6		7.1	0.068			0.019
00NB01AF0002	26-MAR-85	915	0.0	11.2	79.1		7.2	0.019	0.016		0.015
00NB01AF0002	14-AUG-85	935	19.7	7.4	85.3	7.3	7.4	0.070	0.030	0.004	0.014
00NB01AF0014	16-MAY-84	830	5.5	12.8	104.9	7.3	7.7	0.084	0.032	0.001	0.008
00NB01AF0014	27-JUN-84	1310	11.5	10.2	97.4	7.4	7.4	0.060	0.060	0.010	0.019
00NB01AF0014	15-AUG-84	845	19.5	8.4	96.5	7.8	7.7	0.310	0.022	0.006	0.026
00NB01AF0014	30-OCT-84	940	2.5	12.9	97.6	7.4	7.9	0.044	0.010	0.001	0.005
00NB01AF0014	04-DEC-84	1100	0.5	13.0	93.1	6.9	7.5	0.068	0.015	0.001	0.005
00NB01AF0014	29-JAN-85	1000	0.1	14.1	99.8	7.5	7.8	0.012	0.010	0.001	0.002
00NB01AF0014	29-JAN-85	1005					7.8	0.015		0.001	0.004
00NB01AF0014	29-JAN-85	1010					7.8	0.012		0.001	0.002
00NB01AF0014	26-FEB-85	1045	0.2	15.2	107.9		7.6	0.020	0.010	0.004	0.006
00NB01AF0015	16-MAY-84	900	5.3	13.0	106.0		6.7	0.097	0.025	0.001	0.012
00NB01AF0015	27-JUN-84	1340	10.8	10.4	97.6	7.3	7.4	0.060	0.060	0.008	0.031
00NB01AF0015	15-AUG-84	930	17.6	8.4	92.5	7.4	7.3	0.083	0.010	0.007	0.015
00NB01AF0015	30-OCT-84	1010	4.0	12.2	96.1	7.0	7.7	0.035	0.010	0.001	0.004
00NB01AF0015	04-DEC-84	950	0.5	12.8	91.7	6.6	7.2	0.068	0.030	0.001	0.006
00NB01AF0015	30-JAN-85	1550	0.2	12.4	88.1	7.4	7.4	0.010	0.010	0.001	0.002
00NB01AF0015	30-JAN-85	1555					7.4	0.010		0.001	0.002
00NB01AF0015	30-JAN-85	1600					7.7	0.010		0.001	0.002
00NB01AF0015	26-FEB-85	1130	0.2	15.1	107.2		7.3	0.012	0.010	0.005	0.005

TABLE 19 . Dissolved oxygen, pH, aluminum and phosphorus concentrations measured in water samples collected in International Saint John River Basin in 1984 - 1985.

SAMPLING STA. NO.	SDATE		WATER TEMP. (C)	D.O. (mg/l)	D.O. % SAT	pH FIELD (Units)	pH LAB (Units)	Al. EXT. (mg/l)	Al. DISS. (mg/l)	PHOS DISS. (mg/l)	PHOS TOTAL (mg/l)
00NB01AF0019	16-MAY-84	1030	6.0	13.6	113.0		6.7	0.100	0.027	0.001	0.011
00NB01AF0019	27-JUN-84	1445	11.5	10.4	99.3	7.5	7.6	0.040	0.040	0.008	0.015
00NB01AF0019	15-AUG-84	1130	20.0	9.0	104.5	7.8	7.5	0.036	0.012	0.004	0.009
00NB01AF0019	30-OCT-84	1150	5.0	12.4	100.3	7.2	7.4	0.070	0.010	0.001	0.029
00NB01AF0019	04-DEC-84	1330	1.0	14.8	107.5	6.5	7.2	0.045	0.019	0.003	0.007
00NB01AF0019	29-JAN-85	1300	0.2	13.0	92.3	7.3	7.4	0.019	0.010	0.003	0.007
00NB01AF0019	29-JAN-85	1305					7.6	0.010		0.005	0.007
00NB01AF0019	29-JAN-85	1310					7.4	0.012		0.005	0.007
00NB01AF0019	26-FEB-85	1500	0.2	14.9	105.8		7.1	0.014	0.010	0.006	0.007
00NB01AF0019	26-MAR-85	1330	0.1	14.8	104.8		7.3	0.010	0.010		0.005
00NB01AF0021	01-FEB-84	1335	0.2	12.7	90.2		7.4		0.010	0.001	0.013
00NB01AF0021	04-APR-84	1400	0.8	15.2	109.7		6.9		0.010	0.001	0.016
00NB01AF0021	16-MAY-84	945	5.5	14.2	116.4		6.8	0.088	0.013	0.001	0.011
00NB01AF0021	27-JUN-84	1145	12.2	10.6	103.0	7.8	7.5	0.030	0.030	0.001	0.006
00NB01AF0021	27-JUN-84	1150	12.2	10.6	103.0	7.8	7.5	0.020	0.020	0.007	0.022
00NB01AF0021	27-JUN-84	1155	12.2	10.6	103.0	7.8	7.5	0.020	0.020	0.003	0.009
00NB01AF0021	15-AUG-84	1010	20.0	8.8	102.2	7.5	7.6	0.030	0.012	0.002	0.004
00NB01AF0021	30-OCT-84	1045	4.0	13.4	105.6	7.1	7.9	0.010	0.010	0.001	0.004
00NB01AF0021	04-DEC-84	1140	1.5	13.3	97.9	7.0	7.5	0.016	0.010	0.001	0.001
00NB01AF0021	29-JAN-85	1120	0.1	13.0	92.1	7.5	7.6	0.010	0.010	0.001	0.005
00NB01AF0021	26-FEB-85	1215	0.2	13.9	98.7		7.6	0.010	0.010	0.001	0.003
00NB01AF0021	26-MAR-85	1115	0.0	14.1	99.6		7.4	0.010	0.010		0.001
00NB01AF0021	14-MAY-85	820	4.0	12.8	100.8	7.2	7.2	0.058	0.010		0.009
00NB01AF0021	18-JUN-85	850	13.0	9.8	97.0	7.6	7.6	0.010	0.010	0.003	0.008
00NB01AF0021	14-AUG-85	1201	17.5	7.0	76.9	7.9	7.6	0.020	0.010	0.001	0.003
00NB01AF0021	20-NOV-85	815	1.0	12.8	92.9		7.8	0.010	0.010	0.001	0.001
00NB01AF0021	20-NOV-85	820					7.6	0.010	0.010	0.001	0.001
00NB01AF0021	20-NOV-85	825					7.5	0.025	0.010	0.001	0.001
00NB01AF0021	18-DEC-85	930	0.0	12.9	91.1	7.8	7.5	0.013	0.010	0.001	0.003
00NB01AF0023	01-FEB-84	1100					7.6		0.010	0.001	0.008
00NB01AF0023	04-APR-84	1445	0.5	14.5	103.8		7.3		0.015	0.002	0.007
00NB01AF0023	15-MAY-84	1500	5.5	12.8	104.9	7.3	6.9	0.200	0.050	0.003	0.017
00NB01AF0023	27-JUN-84	1045	10.5	10.4	96.9	7.4	7.2	0.100	0.100	0.009	4.000
00NB01AF0023	27-JUN-84	1050	10.5	10.4	96.9	7.4	7.2	0.090	0.090	0.011	0.052
00NB01AF0023	27-JUN-84	1055	10.5	10.4	96.9	7.4	7.2	0.100	0.100	0.009	0.070
00NB01AF0023	14-AUG-84	1400	20.5	9.2	108.0	7.9	7.8	0.100	0.045	0.004	0.011
00NB01AF0023	30-OCT-84	915	4.0	12.2	96.1	7.4	7.9	0.075	0.010	0.001	0.006
00NB01AF0023	04-DEC-84	920	0.5	13.5	96.7	7.0	7.6	0.077	0.042	0.001	0.008
00NB01AF0023	29-JAN-85	920	0.2	12.6	89.5	7.5	8.0	0.012	0.010		0.002
00NB01AF0023	26-FEB-85	945	0.3	13.9	99.0		7.6	0.012			0.002
00NB01AF0023	26-MAR-85	1015	0.0	14.0	98.9		7.6	0.010	0.010		0.001
00NB01AF0023	14-AUG-85	1115	16.7	9.3	100.4	7.9	7.8	0.080	0.020	0.001	0.007
00NB01AF0038	16-MAY-84	1010	5.5	13.7	112.3	7.4	7.7	0.084	0.032	0.003	0.010
00NB01AF0038	27-JUN-84	1415	13.0	10.0	99.0	7.2	7.1	0.040	0.040	0.009	0.023
00NB01AF0038	15-AUG-84	1100	22.4	8.1	99.0	7.5	7.3	0.065	0.043	0.008	0.023
00NB01AF0038	30-OCT-84	1120	7.5	10.5	90.7	7.3	7.6	0.140	0.077	0.019	0.039
00NB01AF0038	04-DEC-84	1215	0.1	12.6	89.2	6.6	7.0	0.140	0.078	0.010	0.025
00NB01AF0038	29-JAN-85	1215	0.1	12.9	91.3	7.5	7.4	0.110	0.110	0.018	0.033
00NB01AF0038	26-FEB-85	1415	0.7	12.5	90.0		6.8	0.240	0.200	0.042	

TABLE 19. Dissolved oxygen, pH, aluminum and phosphorus concentrations measured in water samples collected in International Saint John River Basin in 1984 - 1985.

SAMPLING STA. NO.	SDATE	STIME	WATER TEMP. (C)	D.O. (mg/l)	D.O. % SAT	pH FIELD (Units)	pH LAB (Units)	Al EXT. (mg/l)	Al DISS. (mg/l)	PHOS. DISS. (mg/l)	PHOS. TOTAL (mg/l)
00NB01AF0038	26-FEB-85	1420	0.7	12.5	90.0		6.6	0.200	0.170	0.042	0.047
00NB01AF0038	26-FEB-85	1425	0.7	12.5	90.0		6.7	0.190	0.160	0.041	0.041
00NB01AF0038	26-MAR-85	1145	0.6	13.5	96.9		7.1	0.034	0.028		0.030
00NB01AF0038	14-MAY-85	900	4.5	12.6	100.6	7.4	7.3	0.130	0.031	0.007	0.037
00NB01AF0038	18-JUN-85	915	15.0	10.3	106.9	7.5	7.5	0.030	0.030	0.008	
00NB01AF0038	20-NOV-85	915	1.0	12.4	90.0		7.0	0.073	0.055	0.010	0.024
00NB01AF0038	20-NOV-85	920					7.0	0.071	0.055	0.011	0.020
00NB01AF0038	20-NOV-85	925					7.0	0.071	0.069	0.011	0.017
00NB01AG0003	31-JAN-84	1410	0.0	14.0	98.9		8.0		0.010	0.025	0.028
00NB01AG0003	03-APR-84	1245	4.1	14.8	116.9		8.1		0.015		0.019
00NB01AG0003	15-MAY-84	1146	7.6	13.3	115.2		7.4	0.110	0.025	0.010	0.026
00NB01AG0003	26-JUN-84	1340	12.6	11.3	110.8	8.1	7.9	0.030	0.030	0.018	0.040
00NB01AG0003	14-AUG-84	1115	18.5	10.2	114.6	8.4	8.0	0.036	0.015	0.005	0.011
00NB01AG0003	14-AUG-84	1125	18.5	10.2	114.6	8.4	8.0	0.033	0.014	0.004	0.012
00NB01AG0003	14-AUG-84	1120	18.5	10.2	114.6	8.4	8.0	0.035	0.016	0.005	0.011
00NB01AG0003	29-OCT-84	1430	8.7	13.4	119.3	8.7	8.7	0.022	0.010	0.003	0.011
00NB01AG0003	03-DEC-84	1615	1.8	14.2	105.4	7.4	8.0	0.033	0.014	0.013	0.023
00NB01AG0003	28-JAN-85	1650	0.1	13.3	94.2	8.0	8.1	0.012	0.010	0.037	0.039
00NB01AG0003	28-FEB-85	1130	0.2	15.7	111.5		8.0	0.034	0.022	0.042	0.044
00NB01AG0003	13-MAY-85	1530	7.0	12.0	102.3	8.0	8.0	0.069	0.022	0.012	0.039
00NB01AG0003	17-JUN-85	1550	19.5	8.7	99.9	8.7	8.1	0.050	0.050	0.018	0.027
00NB01AG0003	14-AUG-85	830	14.5	9.3	95.4	8.0	7.8	0.040	0.020	0.008	0.014
00NB01AG0003	19-NOV-85	1410	2.0	13.4	100.0		8.3	0.028	0.011	0.001	0.004
00NB01AG0003	17-DEC-85	1515	0.0	14.7	103.8	7.6	8.1	0.057	0.010	0.016	0.026
00NB01AJ0012	31-JAN-84	930	0.2	13.4	95.2		7.9		0.010	0.015	0.022
00NB01AJ0012	03-APR-84	930	1.0	14.5	105.3		8.0		0.010	0.019	0.028
00NB01AJ0012	15-MAY-84	1000	6.8	13.8	117.1		7.6	0.044	0.012	0.003	0.017
00NB01AJ0012	26-JUN-84	1100	12.2	9.5	92.3	8.1	8.1	0.020	0.020	0.009	0.023
00NB01AJ0012	13-AUG-84	1730	23.0	14.2	175.7	6.5	8.0	0.033	0.015	0.015	0.022
00NB01AJ0012	29-OCT-84	1300	9.5	15.1	137.2	8.3	8.4	0.010	0.010	0.003	0.010
00NB01AJ0012	29-OCT-84	1305					8.3	0.010	0.010	0.003	0.010
00NB01AJ0012	29-OCT-84	1310					8.3	0.010	0.010	0.006	0.009
00NB01AJ0012	03-DEC-84	1420	2.0	14.5	108.2	7.2	7.9	0.015	0.010	0.010	0.014
00NB01AJ0012	28-JAN-85	1430	0.2	12.4	88.1	7.9	8.1	0.010	0.010	0.026	0.030
00NB01AJ0012	28-FEB-85	1400	0.3	14.2	101.1		7.9	0.022	0.010	0.024	0.023
00NB01AJ0012	25-MAR-85	1600	0.1	14.3	101.3		8.0	0.010	0.010		0.014
00NB01AJ0012	13-MAY-85	1330	8.2	12.2	107.3	8.0	7.9	0.031	0.010	0.010	0.017
00NB01AJ0012	13-MAY-85	1340		12.2		8.0	7.8	0.025	0.010	0.008	0.017
00NB01AJ0012	13-MAY-85	1350		12.2		8.0	7.7	0.028	0.010	0.007	0.017
00NB01AJ0012	17-JUN-85	1420					7.9	0.010	0.010	0.010	0.025
00NB01AJ0012	17-JUN-85	1415					8.0	0.010	0.010	0.015	0.023
00NB01AJ0012	17-JUN-85	1410	20.0	13.1	132.1	8.9	7.8	0.010	0.010	0.019	0.019
00NB01AJ0012	13-AUG-85	1510	21.5	15.5	185.8	9.2	8.5	0.020	0.010	0.008	0.014
00NB01AJ0012	19-NOV-85	1215	0.5	13.8	98.8		8.1	0.012	0.010	0.001	0.001
00NB01AJ0012	17-DEC-85	1340	0.0	12.1	85.4	7.6	8.0	0.010	0.010	0.012	0.014
00NB01AJ0029	30-JAN-84	1500	0.6	14.2	102.0		7.8		0.015	0.007	0.009
00NB01AJ0029	02-APR-84	1435	0.4	14.2	101.4		7.4		0.010	0.006	0.018

TABLE 19 . Dissolved oxygen, pH, aluminum and phosphorus concentrations measured in water samples collected in International Saint John River Basin in 1984 - 1985.

SAMPLING STA. NO.	SDATE	STIME	WATER TEMP.	D.O. (mg/l)	D.O. % SAT	pH FIELD	pH LAB	Al EXT.	Al DISS.	PHOS. DISS.	PHOS. TOTAL
00NB01AJ0029	15-MAY-84	830	7.3	12.6	108.3	7.7	7.0	0.065	0.045	0.002	0.016
00NB01AJ0029	26-JUN-84	930	13.5	10.4	104.2	7.9	7.7	0.030	0.030	0.009	0.017
00NB01AJ0029	13-AUG-84	1615	23.5	11.5	143.8	8.8	8.3	0.027	0.022	0.005	0.007
00NB01AJ0029	29-OCT-84	1130	10.0	10.8	99.4	7.9	8.0	0.010	0.010	0.001	0.005
00NB01AJ0029	29-OCT-84	1135					8.1	0.010	0.010	0.001	0.005
00NB01AJ0029	29-OCT-84	1140					7.9	0.010	0.010	0.001	0.004
00NB01AJ0029	03-DEC-84	1210	0.6	15.0	107.7	7.3	7.6	0.030	0.018	0.011	0.012
00NB01AJ0029	28-JAN-85	1230		12.9		7.7	7.7	0.010	0.010	0.013	0.021
00NB01AJ0029	28-FEB-85	1515	0.3	15.0	106.8		7.3	0.026	0.010	0.025	0.025
00NB01AJ0029	25-MAR-85	1430	0.0	14.6	103.1		7.2	0.010	0.013		0.014
00NB01AJ0029	13-MAY-85	1150	10.0	11.3	104.0	7.8	7.7	0.037	0.020	0.008	0.017
00NB01AJ0029	13-MAY-85	1201		11.3		7.8	7.8	0.034	0.022	0.007	0.012
00NB01AJ0029	13-MAY-85	1210		11.3		7.8	7.8	0.030	0.020		0.014
00NB01AJ0029	17-JUN-85	1235	16.5	10.4	111.7	8.0	7.6	0.020	0.020	0.004	0.010
00NB01AJ0029	13-AUG-85	1315	19.6	8.5	97.8	8.6	8.1	0.020	0.010	0.011	0.017
00NB01AJ0029	19-NOV-85	1115	1.0	13.4	97.3		7.6	0.040	0.030	0.001	0.003
00NB01AJ0029	17-DEC-85	1230	0.0	14.8	104.5	7.5	7.7	0.017	0.013	0.008	0.011
01NB01AF0005	31-JAN-84	1545	0.3	13.8	98.3					0.006	
01NB01AF0005	03-APR-84	1415	0.5	12.8	91.7		6.8		0.045	0.008	0.008
01NB01AF0005	15-MAY-84	1330	6.3	12.8	107.2	7.1	6.7	0.140	0.045	0.003	0.016
01NB01AF0005	26-JUN-84	1430	15.8	9.1	96.2	7.3	7.1	0.060	0.060	0.011	0.013
01NB01AF0005	14-AUG-84	1500	22.3	7.7	93.9	7.5	7.4	0.065	0.030	0.006	0.020
01NB01AF0005	14-AUG-84	1505	22.3	7.7	93.9	7.5	7.4	0.062	0.025	0.005	0.014
01NB01AF0005	14-AUG-84	1510	22.3	7.7	93.9	7.5	7.4	0.065	0.016	0.005	0.013
01NB01AF0005	29-OCT-84	1520	8.7	8.5	75.7	6.7	7.5	0.083	0.045	0.006	0.016
01NB01AF0005	03-DEC-84	1700	1.5	12.6	92.7	7.4	7.2	0.083	0.048		0.023
01NB01AF0005	28-JAN-85	1755	0.2	10.9	77.4	7.3	7.3	0.055	0.040	0.005	0.011
01NB01AF0005	28-FEB-85	915	0.3	10.5	74.8		7.0	0.068	0.052	0.022	0.023
01NB01AF0005	26-MAR-85	840	0.0	10.8	76.3		7.0	0.028	0.014		0.014
01NB01AF0005	13-MAY-85	1630	6.2	11.8	98.5	7.6	7.5	0.069	0.045	0.004	0.010
01NB01AF0005	17-JUN-85	1645	16.0	9.4	99.8	7.4	7.5	0.040	0.040	0.005	0.013
01NB01AF0005	14-AUG-85	1500	21.8	6.5	78.4	7.5	7.4	0.055	0.030	0.004	0.014
01NB01AF0005	19-NOV-85	1515	0.5	12.9	92.4		7.2	0.067	0.056	0.001	0.004
01NB01AF0005	17-DEC-85	1645	0.0	12.7	89.7	7.3	7.2	0.065	0.040	0.008	0.016
01NB01AF0005	17-DEC-85	1201						0.010	0.010	0.001	0.001
01NB01AF0005	18-DEC-85	1201						0.010	0.010	0.001	0.001
01NB01AG0001	31-JAN-84	1130	0.6	14.0	100.5		7.2		0.032	0.032	0.036
01NB01AG0001	03-APR-84	1130	0.5	12.6	90.2		6.9		0.030	0.014	0.023
01NB01AG0001	15-MAY-84	1115	8.0	11.8	103.2	7.1	7.0	0.100	0.054	0.011	0.019
01NB01AG0001	26-JUN-84	1300	15.5	9.5	99.7	7.8	7.5	0.050	0.050	0.022	0.028
01NB01AG0001	14-AUG-84	945	23.2	7.2	89.4	7.9	7.8	0.045	0.030	0.013	0.029
01NB01AG0001	14-AUG-84	950	23.2	7.2	89.4	7.6	7.7	0.043	0.030	0.012	0.030
01NB01AG0001	14-AUG-84	955	23.2	7.2	89.4	7.9	7.5	0.041	0.025	0.013	0.030
01NB01AG0001	29-OCT-84	1410				7.5	7.6	0.030	0.010	0.026	0.038
01NB01AG0001	03-DEC-84	1545	1.0	13.6	98.7	7.4	6.8	0.048	0.030	0.017	0.023
01NB01AG0001	28-JAN-85	1610	0.2	9.7	68.9	7.1	7.3	0.020	0.013	0.100	0.100
01NB01AG0001	28-FEB-85	1201	0.3	11.3	80.5		7.1	0.036	0.020	0.060	0.350
01NB01AG0001	25-MAR-85	1650	0.2	12.5	88.8		7.0	0.024	0.027		0.042
01NB01AG0001	13-MAY-85	1500	9.4	10.6	96.1	7.0	7.1	0.080	0.045	0.013	0.020

TABLE 19. Dissolved oxygen, pH, aluminum and phosphorus concentrations measured in water samples collected in International Saint John River Basin in 1984 - 1985.

SAMPLING STA. NO.	SDATE	STIME	WATER TEMP. (C)	D.O. (mg/l)	D.O. % SAT	pH FIELD (Units)	pH LAB (Units)	Al EXT. (mg/l)	Al DISS. (mg/l)	PHOS. DISS. (mg/l)	PHOS. TOTAL (mg/l)
01NB01AG0001	17-JUN-85	1535					7.3	0.050	0.050	0.030	0.042
01NB01AG0001	17-JUN-85	1540					7.3	0.050	0.050	0.032	0.042
01NB01AG0001	17-JUN-85	1530	17.5	9.0	98.9	7.7	7.2	0.050	0.040	0.030	0.042
01NB01AG0001	13-AUG-85	1515	23.0	8.1	100.2	8.3	7.6	0.055	0.030	0.021	0.046
01NB01AG0001	19-NOV-85	1340	0.5	13.3	95.2		7.3	0.082	0.058		
01NB01AG0001	17-DEC-85	1445	0.0	12.7	89.7	7.2	7.5	0.045	0.032	0.047	0.051

TABLE 20. Suspended solids and heavy metal concentrations measured in water samples collected in International Saint John River Basin in 1984-1985.

SAMPLING STA. NO.	SDATE	STIME	SUSP. SOLIDS	EXT. Cu (mg/l)	EXT. Pb (mg/l)	EXT. Zn (mg/l)	EXT. Hg (ug/l)
00NB01AD0001	17-MAY-84	1045		L.002	L.002	L.01	L.02
00NB01AD0001	04-JUL-84	1245	L10.	L.002	L.002	L.01	L.02
00NB01AD0001	15-AUG-84	1145	L10.	L.002	L.002	0.01	L.02
00NB01AD0001	30-OCT-84	1650	L10.	L.002	L.002	L.01	L.02
00NB01AD0001	05-DEC-84	1100	L10.	L.002	L.002	L.01	L.02
00NB01AD0001	14-MAY-85	1205	L10.	L.002	L.002	L.01	L.02
00NB01AD0001	18-JUN-85	1100	L10.	L.002	L.002	L.01	L.02
00NB01AD0001	15-AUG-85	1150	L10.	L.002	L.002	L.01	L.02
00NB01AD0001	20-NOV-85	1100	L10.	L.002	L.002	L.01	L.02
00NB01AD0008	17-MAY-84	1201		L.002	L.002	L.01	L.02
00NB01AD0008	27-JUN-84	1600	L10.	0.003	L.002	L.01	L.02
00NB01AD0008	15-AUG-84	1415	L10.	L.002	L.002	0.01	L.02
00NB01AD0008	30-OCT-84	1230	L10.	L.002	L.002	L.01	L.02
00NB01AD0008	05-DEC-84	1201		0.002	L.002	L.01	L.02
00NB01AD0008	29-JAN-85	1450	L10.	L.002	L.002	L.01	L.02
00NB01AD0008	27-FEB-85	1630	L10.				
00NB01AD0008	26-MAR-85	1410	L10.	L.002	L.002	L.01	L.02
00NB01AD0008	14-MAY-85	1000	L10.	0.002	L.002	L.01	L.02
00NB01AD0008	18-JUN-85	1010	L10.	L.002	L.002	L.01	L.02
00NB01AD0008	20-NOV-85	1015	L10.	0.002	0.002	L.01	L.02
00NB01AD0009	16-MAY-84	1300	L10.	L.002	L.002	L.01	L.02
00NB01AD0009	28-JUN-84	1110	L10.	L.002	L.002	L.01	L.02
00NB01AD0009	16-AUG-84	1201	L10.	L.002	L.002	0.01	L.02
00NB01AD0009	30-OCT-84	1515	L10.	L.002	L.002	L.01	L.02
00NB01AD0009	30-JAN-85	1015	L10.	L.002	L.002	L.01	L.02
00NB01AD0009	27-FEB-85	1115	L10.				
00NB01AD0009	27-MAR-85	1030	L10.	L.002	L.002	L.01	L.02
00NB01AD0013	16-MAY-84	1210		L.002	L.002	L.01	
00NB01AD0013	16-MAY-84	1205		L.002	L.002	L.01	
00NB01AD0013	16-MAY-84	1201		L.002	L.002	L.01	L.02
00NB01AD0013	28-JUN-84	1000	L10.	L.002	L.002	L.01	L.02
00NB01AD0013	15-AUG-84	930	L10.	L.002	L.002	0.01	L.02
00NB01AD0013	30-OCT-84	1415	L10.	0.003	L.002	L.01	L.02
00NB01AD0013	05-DEC-84	900	L10.	L.002	L.002	L.01	L.02
00NB01AD0013	30-JAN-85	930	L10.	L.002	L.002	L.01	L.02
00NB01AD0013	27-FEB-85	1030	L10.				
00NB01AD0013	14-MAY-85	1130	L10.	L.002	L.002	L.01	L.02
00NB01AD0013	18-JUN-85	1225	L10.	L.002	L.002	L.01	L.02
00NB01AD0013	15-AUG-85	1030	L10.	L.002	L.002	L.01	L.02
00NB01AD0013	20-NOV-85	1201	L10.	L.002	L.002	L.01	L.02
00NB01AD0016	17-MAY-84	1220		L.002	L.002	L.01	
00NB01AD0016	17-MAY-84	1230		L.002	L.002	L.01	
00NB01AD0016	17-MAY-84	1210		L.002	L.002	L.01	L.02
00NB01AD0016	27-JUN-84	1530	48.	L.002	L.002	L.01	L.02
00NB01AD0016	15-AUG-84	1345	L10.	L.002	L.002	0.01	L.02
00NB01AD0016	30-OCT-84	1210	11.	L.002	L.002	0.02	L.02

TABLE 20. Suspended solids and heavy metal concentrations measured in water samples collected in International Saint John River Basin in 1984-1985.

SAMPLING STA. NO.	SDATE	STIME	SUSP. SOLIDS	EXT. Cu (mg/l)	EXT. Pb (mg/l)	EXT. Zn (mg/l)	EXT. Hg (ug/l)
00NB01AD0016	04-DEC-84	1400	L10.	L.002	L.002	L.01	L.02
00NB01AD0016	04-DEC-84	1201		L.002	L.002	L.01	L.02
00NB01AD0016	29-JAN-85	1520	L10.	L.002	L.002	L.01	L.02
00NB01AD0016	26-FEB-85	1530	L10.				
00NB01AD0016	26-MAR-85	1345	L10.	L.002	L.002	L.01	L.02
00NB01AD0016	14-MAY-85	930	L10.	L.002	L.002	L.01	L.02
00NB01AD0016	18-JUN-85	1000	L10.	L.002	L.002	L.01	L.02
00NB01AD0016	14-AUG-85	1345	L10.	L.002	L.002	L.01	L.02
00NB01AD0016	20-NOV-85	1000	L10.	L.002	L.002	L.01	L.02
00NB01AD0016	18-DEC-85	1025	L10.	L.002	L.002	L.01	L.02
00NB01AD0017	16-MAY-84	1415		L.002	L.002	L.01	L.02
00NB01AD0017	16-MAY-84	1420		L.002	L.002	L.01	
00NB01AD0017	16-MAY-84	1425		0.002	L.002	L.01	
00NB01AD0017	04-JUL-84	1350	L10.	L.002	L.002	L.01	L.02
00NB01AD0017	16-AUG-84	1330	L10.	0.002	L.002	0.01	L.02
00NB01AD0017	30-OCT-84	1700	L10.	L.002	L.002	L.01	L.02
00NB01AD0017	30-OCT-84	1201		L.002	L.002	L.01	L.02
00NB01AD0017	05-DEC-84	1330	L10.	L.002	L.002	L.01	L.02
00NB01AD0017	30-JAN-85	1400	L10.	L.002	L.002	L.01	L.02
00NB01AD0017	27-MAR-85	1430	L10.	L.002	0.002	0.01	L.02
00NB01AD0019	16-MAY-84	1500		L.002	L.002	L.01	L.02
00NB01AD0019	04-JUL-84	1415	27.	L.002	L.002	L.01	L.02
00NB01AD0019	16-AUG-84	1415	18.4	L.002	0.002	0.01	L.02
00NB01AD0019	05-DEC-84	1430	L10.	L.002	L.002	L.01	L.02
00NB01AD0019	30-JAN-85	1430	L10.	L.002	L.002	L.01	L.02
00NB01AD0019	27-FEB-85	1530	L10.				
00NB01AD0019	27-MAR-85	1450	L10.	L.002	L.002	L.01	L.02
00NB01AD0031	17-MAY-84	930		L.002	L.002	L.01	L.02
00NB01AD0031	28-JUN-84	1300	L10.	L.002	L.002	L.01	L.02
00NB01AD0031	16-AUG-84	1235	L10.	L.002	L.002	0.01	L.02
00NB01AD0031	30-OCT-84	1600	L10.	L.002	L.002	L.01	L.02
00NB01AD0031	05-DEC-84	1145	L10.	L.002	L.002	L.01	L.02
00NB01AD0031	30-JAN-85	1120	L10.	L.002	L.002	L.01	L.02
00NB01AD0031	27-MAR-85	1145	L10.	0.005	L.002	L.01	L.02
00NB01AF0002	15-MAY-84	1430	13.	L.002	L.002	L.01	L.02
00NB01AF0002	26-JUN-84	1615	29.8	L.002	L.002	L.01	L.02
00NB01AF0002	26-JUN-84	1620	15.	L.002	L.002	L.01	L.02
00NB01AF0002	26-JUN-84	1625	10.	L.002	0.002	L.01	L.02
00NB01AF0002	14-AUG-84	1330	L10.	L.002	L.002	0.01	L.02
00NB01AF0002	30-OCT-84	820	L10.	L.002	L.002	L.01	L.02
00NB01AF0002	04-DEC-84	845	L10.	L.002	L.002	L.01	L.02
00NB01AF0002	29-JAN-85	840	L10.	L.002	0.002	L.01	L.02
00NB01AF0002	26-FEB-85	900	L10.				
00NB01AF0002	26-MAR-85	915	L10.	L.002	L.002	L.01	L.02
00NB01AF0002	14-AUG-85	935	L10.	L.002	L.002	L.01	L.02
00NB01AF0014	16-MAY-84	830		L.002	L.002	L.01	L.02

TABLE 20. Suspended solids and heavy metal concentrations measured in water samples collected in International Saint John River Basin in 1984-1985.

SAMPLING STA. NO.	SDATE	STIME	SUSP. SOLIDS	EXT. Cu (mg/l)	EXT. Pb (mg/l)	EXT. Zn (mg/l)	EXT. Hg (ug/l)
00NB01AF0014	27-JUN-84	1310	125.	L.002	L.002	L.01	L.02
00NB01AF0014	15-AUG-84	845	20.5	L.002	L.002	0.01	L.02
00NB01AF0014	30-OCT-84	940	L10.	L.002	L.002	L.01	L.02
00NB01AF0014	04-DEC-84	1100	L10.	L.002	L.002	L.01	L.02
00NB01AF0014	26-FEB-85	1045	L10.				
00NB01AF0015	16-MAY-84	900	L10.	L.002	L.002	L.01	L.02
00NB01AF0015	27-JUN-84	1340	51.	0.003	L.002	L.01	L.02
00NB01AF0015	15-AUG-84	930	L10.	L.002	L.002	0.01	L.02
00NB01AF0015	30-OCT-84	1010	L10.	L.002	L.002	L.01	L.02
00NB01AF0015	04-DEC-84	950	L10.	L.002	L.002	L.01	L.02
00NB01AF0015	26-FEB-85	1130	L10.				
00NB01AF0019	16-MAY-84	1030		L.002	L.002	L.01	L.02
00NB01AF0019	27-JUN-84	1445	24.	0.002	L.002	L.01	L.02
00NB01AF0019	15-AUG-84	1130	L10.	L.002	L.002	0.01	L.02
00NB01AF0019	30-OCT-84	1150	L10.	L.002	L.002	L.01	L.02
00NB01AF0019	04-DEC-84	1330	L10.	L.002	L.002	L.01	L.02
00NB01AF0019	26-FEB-85	1500	L10.				
00NB01AF0019	26-MAR-85	1330	L10.	L.002	L.002	L.01	L.02
00NB01AF0021	16-MAY-84	945	11.	L.002	L.002	L.01	L.02
00NB01AF0021	27-JUN-84	1145	19.2	0.002	0.002	L.01	L.02
00NB01AF0021	27-JUN-84	1150	L10.	0.002	0.006	L.01	L.02
00NB01AF0021	27-JUN-84	1155	L10.	0.002	L.002	L.01	L.02
00NB01AF0021	15-AUG-84	1010	L10.	L.002	L.002	0.01	L.02
00NB01AF0021	30-OCT-84	1045	L10.	L.002	L.002	L.01	L.02
00NB01AF0021	04-DEC-84	1140	L10.	L.002	L.002	L.01	L.02
00NB01AF0021	29-JAN-85	1120	L10.	L.002	L.002	L.01	L.02
00NB01AF0021	26-FEB-85	1215	L10.				
00NB01AF0021	26-MAR-85	1115	L10.	L.002	L.002	L.01	L.02
00NB01AF0021	14-MAY-85	820	L10.	L.002	L.002	L.01	L.02
00NB01AF0021	18-JUN-85	850	L10.	L.002	L.002	L.01	L.02
00NB01AF0021	14-AUG-85	1201	L10.	0.004	L.002	L.01	L.02
00NB01AF0021	18-DEC-85	930	L10.	L.002	L.002	L.01	L.02
00NB01AF0023	15-MAY-84	1500	14.	L.002	L.002	L.01	L.02
00NB01AF0023	27-JUN-84	1045	207.	L.002	0.002	L.01	L.02
00NB01AF0023	27-JUN-84	1050	276.	L.002	0.002	L.01	L.02
00NB01AF0023	27-JUN-84	1055	364.	0.002	0.002	L.01	L.02
00NB01AF0023	14-AUG-84	1400	L10.	L.002	L.002	L.01	L.02
00NB01AF0023	30-OCT-84	915	L10.	L.002	L.002	L.01	L.02
00NB01AF0023	04-DEC-84	920	L10.	L.002	L.002	L.01	L.02
00NB01AF0023	29-JAN-85	920	L10.	L.002	L.002	L.01	L.02
00NB01AF0023	26-FEB-85	945	L10.				
00NB01AF0023	26-MAR-85	1015	L10.	L.002	L.002	L.01	L.02
00NB01AF0023	14-AUG-85	1115	L10.	L.002	L.002	L.01	L.02
00NB01AF0038	16-MAY-84	1010		L.002	L.002	L.01	L.02
00NB01AF0038	27-JUN-84	1415	L10.	0.003	L.002	L.01	L.02
00NB01AF0038	15-AUG-84	1100	L10.	L.002	L.002	0.01	L.02

TABLE 20. Suspended solids and heavy metal concentrations measured in water samples collected in International Saint John River Basin in 1984-1985.

SAMPLING STA. NO.	SDATE	STIME	SUSP. SOLIDS	EXT. Cu (mg/l)	EXT. Pb (mg/l)	EXT. Zn (mg/l)	EXT. Hg (ug/l)
00NB01AF0038	30-OCT-84	1120	L10.	L.002	L.002	0.01	L.02
00NB01AF0038	04-DEC-84	1215	L10.	L.002	L.002	L.01	L.02
00NB01AF0038	29-JAN-85	1215	L10.	L.002	L.002	L.01	L.02
00NB01AF0038	26-MAR-85	1145	L10.	L.002	L.002	L.01	L.02
00NB01AF0038	14-MAY-85	900	L10.	L.002	0.002	L.01	L.02
00NB01AF0038	18-JUN-85	915	L10.	L.002	L.002	L.01	L.02
00NB01AG0003	15-MAY-84	1146		0.002	L.002	L.01	L.02
00NB01AG0003	26-JUN-84	1340	102.2	L.002	L.002	L.01	L.02
00NB01AG0003	29-OCT-84	1430	L10.	L.002	L.002	L.01	L.02
00NB01AG0003	03-DEC-84	1615	L10.	L.002	L.002	L.01	L.02
00NB01AG0003	28-JAN-85	1650	L10.	L.002	L.002	L.01	L.02
00NB01AG0003	28-FEB-85	1130	L10.				
00NB01AG0003	13-MAY-85	1530	L10.	L.002	L.002	L.01	L.02
00NB01AG0003	17-JUN-85	1550	L10.	L.002	L.002	L.01	L.02
00NB01AG0003	14-AUG-85	830	L10.	L.002	L.002	L.01	L.02
00NB01AG0003	19-NOV-85	1410	L10.	L.002	L.002	L.01	L.02
00NB01AG0003	17-DEC-85	1515	25.	0.002	0.003	L.01	L.02
00NB01AJ0012	15-MAY-84	1000		0.002	L.002	L.01	L.02
00NB01AJ0012	26-JUN-84	1100	21.	L.002	L.002	L.01	L.02
00NB01AJ0012	13-AUG-84	1730	L10.	L.002	L.002	L.01	L.02
00NB01AJ0012	03-DEC-84	1420	L10.	L.002	L.002	L.01	L.02
00NB01AJ0012	28-JAN-85	1430	L10.	L.002	L.002	L.01	L.02
00NB01AJ0012	28-FEB-85	1400	L10.	L.002	L.002	L.01	L.02
00NB01AJ0012	25-MAR-85	1600	L10.	L.002	L.002	L.01	L.02
00NB01AJ0012	13-AUG-85	1510	L10.	L.002	L.002	L.01	L.02
00NB01AJ0012	19-NOV-85	1215	L10.	L.002	L.002	L.01	L.02
00NB01AJ0012	17-DEC-85	1340	L10.	L.002	L.002	L.01	L.02
00NB01AJ0029	15-MAY-84	830		L.002	L.002	L.01	L.02
00NB01AJ0029	26-JUN-84	930	20.	L.002	L.002	L.01	L.02
00NB01AJ0029	13-AUG-84	1615	L10.	0.003	L.002	L.01	L.02
00NB01AJ0029	03-DEC-84	1210	L10.	L.002	L.002	L.01	L.02
00NB01AJ0029	28-JAN-85	1230	L10.	L.002	L.002	L.01	L.02
00NB01AJ0029	28-FEB-85	1515	L10.				
00NB01AJ0029	25-MAR-85	1430	L10.	L.002	L.002	L.01	L.02
00NB01AJ0029	17-JUN-85	1235	L10.	L.002	L.002	L.01	L.02
00NB01AJ0029	13-AUG-85	1315	L10.	L.002	L.002	L.01	L.02
00NB01AJ0029	19-NOV-85	1115	L10.	L.002	L.002	L.01	L.02
00NB01AJ0029	17-DEC-85	1230	L10.	L.002	L.002	L.01	L.02
01NB01AF0005	15-MAY-84	1330		L.002	L.002	L.01	L.02
01NB01AF0005	26-JUN-84	1430	31.	L.002	L.002	L.01	L.02
01NB01AF0005	29-OCT-84	1201		L.002	L.002	L.01	L.02
01NB01AF0005	29-OCT-84	1520	L10.	L.002	L.002	L.01	L.02
01NB01AF0005	03-DEC-84	1201					L.02
01NB01AF0005	03-DEC-84	1700	L10.	L.002	L.002	L.01	L.02
01NB01AF0005	28-JAN-85	1755	L10.	L.002	0.002	L.01	L.02
01NB01AF0005	28-JAN-85	1201		L.002	L.002	L.01	L.02
01NB01AF0005	29-JAN-85	1201		L.002	L.002	L.01	L.02

TABLE 20. Suspended solids and heavy metal concentrations measured in water samples collected in International Saint John River Basin in 1984-1985.

SAMPLING STA. NO.	SDATE	STIME	SUSP. SOLIDS	EXT. Cu (mg/l)	EXT. Pb (mg/l)	EXT. Zn (mg/l)	EXT. Hg (ug/l)
01NB01AF0005	30-JAN-85	1201		L.002	L.002	L.01	L.02
01NB01AF0005	28-FEB-85	915	L10.				
01NB01AF0005	26-MAR-85	840	L10.	L.002	L.002	L.01	L.02
01NB01AF0005	13-MAY-85	1630	L10.	L.002	L.002	L.01	L.02
01NB01AF0005	13-MAY-85	1201		L.002	L.002	L.01	L.02
01NB01AF0005	14-MAY-85	1201		L.002	L.002	L.01	L.02
01NB01AF0005	17-JUN-85	1201		L.002	L.002	L.01	L.02
01NB01AF0005	17-JUN-85	1645	L10.	L.002	L.002	L.01	L.02
01NB01AF0005	18-JUN-85	1201		L.002	L.002	L.01	L.02
01NB01AF0005	14-AUG-85	1500	L10.	L.002	L.002	L.01	L.02
01NB01AF0005	19-NOV-85	1201		L.002	L.002	L.01	L.02
01NB01AF0005	19-NOV-85	1515	L10.	L.002	L.002	L.01	L.02
01NB01AF0005	20-NOV-85	1201		L.002	L.002	L.01	
01NB01AF0005	17-DEC-85	1201		L.002	L.002	L.01	L.02
01NB01AF0005	17-DEC-85	1645	L10.	L.002	L.002	L.01	L.02
01NB01AF0005	18-DEC-85	1201		L.002	L.002	L.01	L.02
01NB01AG0001	15-MAY-84	1115		L.002	L.002	L.01	L.02
01NB01AG0001	26-JUN-84	1300	18.4	L.002	L.002	L.01	L.02
01NB01AG0001	29-OCT-84	1410	L10.	L.002	L.002	L.01	L.02
01NB01AG0001	03-DEC-84	1545	L10.	L.002	L.002	L.01	L.02
01NB01AG0001	28-JAN-85	1610	L10.	L.002	L.002	L.01	L.02
01NB01AG0001	28-FEB-85	1201	L10.				
01NB01AG0001	25-MAR-85	1650	L10.	L.002	L.002	L.01	L.02
01NB01AG0001	13-MAY-85	1500	L10.	L.002	L.002	L.01	L.02
01NB01AG0001	13-AUG-85	1515	L10.	L.002	L.002	L.01	L.02
01NB01AG0001	19-NOV-85	1340	L10.	L.002	L.002	L.01	L.02
01NB01AG0001	17-DEC-85	1445	L10.	L.002	L.002	L.01	L.02